RECORD OF DECISION

VOCs in Groundwater
OPERABLE UNIT

Indian Bend Wash Superfund Site, South Area
Tempe, Arizona

U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Declaration
Decision Summary
Responsiveness Summary

September 1998

3918 - 03149

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

To: Addressees on Attached List:

Re: Transmittal of IBW-South VOCs in Groundwater Operable Unit ROD and Meeting Announcement

Dear Sir or Madam:

Enclosed is a copy of the EPA Record of Decision (ROD) for the VOCs in Groundwater Operable Unit for the Indian Bend Wash Superfund Site, South Area, dated September 1998. We apologize for the delay in sending this document to you and hope that it has not inconvenienced you.

EPA would like to meet with the groundwater stakeholders to briefly discuss the remedy and future plans for implementing the remedy for the eastern and central VOC contaminant areas. In addition, I will use this opportunity to transfer remedial project manager responsibilities for IBW-South to Nancy Riveland, whom you have met at previous groundwater update meetings.

The meeting with the stakeholders will be held on Tuesday, March 23, 1999, at 1:30 p.m. in Conference Room 1710 of the ADEQ offices, 3033 North Central Avenue, Phoenix, Arizona. At 3:00 p.m., EPA would like to meet with the PRPs to discuss future plans for the Site.

Please call me at the EPA Region 3 Philadelphia office at 215/814-3107 or Nancy Riveland at the Region 9 San Francisco office at 415/744-2371 if you have questions regarding this letter or the meeting.

I look forward to meeting with you again regarding this remedy.

Sincerely,

Roberta Riccio

Roberta Riccio
Remedial Project Manager
Superfund Division

Enclosure

3918-03149

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Acronyms and Abbreviations

µg/L	micrograms per liter
A&Ww	aquatic and wildlife (warm water fishery) (water quality criteria for the State of Arizona)
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
APS Octotillo Power Plant	Arizona Public Service Ocotillo Power Plant
ARAR	applicable or relevant and appropriate requirement
ASU	Arizona State University
AT	averaging time
bgs	below ground surface
BW	body weight
C_a	chemical concentration in air
C_w	chemical concentration in water
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
COT	City of Tempe
DC	dual-cast
DCE	dichloroethene
DNAPL	dense nonaqueous-phasee liquid
DO	dissolved oxygen
EC	electrical conductivity
ED	exposure duration
EF	exposure frequency

EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
ft/day	feet per day
ft/ft	foot per foot
ft^2/day	square feet per day
GRA	General Response Action
HBGL	Human Health-Based Guidance Levels
HDPE	high-density polyethelyne
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
IBW-North	Indian Bend Wash Superfund Site-North Area
IBW-South	Indian Bend Wash Superfund Site-South Area
ILCR	increased lifetime cancer risk
Inw	daily water ingestion rate
Ir_a	daily inhalation rate
IRI	Interim Remedial Investigation
IRIS	Integrated Risk Information Service
kg	kilogram
K_p	dermal permeability coefficient
LAU	Lower Alluvial Unit
LGAC	liquid-phase granular activated carbon
m^3/day	cubic meters per day
MAU	Middle Alluvial Unit
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
mgd	million gallons per day

MNA	monitored natural attenuation
MTBE	methyl tertiary butyl ether
MW	Monitoring Well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OSWER	EPA's Office of Solid Waste and Emergency Response
OU	Operable Unit
PCE	perchloroethene (tetrachloroethene)
ppb	parts per billion
PRG	Preliminary Remediation Goal
PRP	potentially responsible party
QA	quality assurance
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act, 42 USC Sec. 6901, et seq., as amended
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/ Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SA	exposed skin surface area
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SRP	Salt River Project
SVE	soil vapor extraction
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene

TOC	total organic carbon
UAU	Upper Alluvial Unit
UIC	underground injection control
USDW	underground sources of drinking water
VGAC	vapor-phase granular activated carbon
VOC	volatile organic compound

I. DECLARATION

I. Declaration

1. Site Name and Location

This Record of Decision (ROD) is for the Indian Bend Wash Superfund Site, South Area (IBW-South), located in the City of Tempe and Maricopa County, Arizona.

2. Statement of Basis and Purpose

This ROD presents the selected remedial action for volatile organic compounds (VOCs) in groundwater at IBW-South in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, (NCP). The decision in this ROD is based on the Administrative Record for this site.

The U.S. Environmental Protection Agency (EPA) has already addressed VOC contamination in the vadose zone for the soil operable unit (OU) at IBW-South in a ROD issued September 1993. This ROD and the September 1993 ROD constitute the overall final remedy for VOCs in groundwater at the IBW-South Site.

The State of Arizona, acting by and through its Department of Environmental Quality (ADEQ), concurs with the remedy selected in this document.

3. Assessment of the Site

Releases of VOCs, e.g., common industrial solvents such as trichloroethene (TCE), perchloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA), from several individual facilities have contaminated the groundwater at IBW-South. Actual or threatened releases of hazardous substances at or from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

IBW-South contains multiple, distinct facilities that are releasing or that have released VOCs into groundwater. VOCs were originally detected in groundwater production wells in the Tempe area in 1982. Since then, EPA has detected VOCs in groundwater production and monitoring wells and in soil at individual properties within the study area. This contamination has moved downward through the soil above the water table and reached groundwater. City of Tempe public water supply wells exist within and surrounding the IBW-South site; however, City of Tempe (City) residents currently receive water from surface-water supplies, not from City of Tempe wells with contaminated groundwater in the IBW-South area. Nonetheless, contamination in the groundwater represents loss of a groundwater resource that is considered a future source of drinking water by the State of Arizona and the City of Tempe. The City has expressed the desire that the groundwater be restored.

4. Description of the Selected Remedy

This ROD presents EPA's remedy and contingency remedy for groundwater. A remedy for the Operable Unit for VOCs in Soils was established in a 1993 ROD. This ROD addresses the Groundwater Operable Unit. Together the 1993 ROD and this ROD form the remedy for VOC contamination at IBW-South.

The Selected Remedy

This remedy addresses VOC contamination in groundwater at IBW-South through the following actions:

- Extraction of the western Upper Alluvial Unit (UAU) area of VOC-contaminated groundwater to attain aquifer cleanup standards and hydraulic containment of the contaminated areas to inhibit both lateral and vertical migration.
- Treatment of extracted water to performance standards using liquid granular activated carbon (LGAC), air stripping with vapor granular activated carbon (VGAC), or ultraviolet light oxidation (UV/Ox)
- Discharge of treated groundwater to the City of Tempe storm drain system leading to Town Lake, the Salt River Project's (SRP) Tempe Canal No. 6, or reinjection.[1]
- Monitored natural attenuation (MNA) of the central and eastern UAU areas of VOC-contaminated groundwater and the Middle Alluvial Unit (MAU) areas of VOC-contaminated groundwater to attain aquifer cleanup standards within those areas, and to prevent migration of groundwater contaminated above the aquifer cleanup standards to and beyond the compliance boundaries established in this ROD.
- The establishment of compliance boundaries for those areas where the MNA remedy is selected. The compliance boundaries represent borders beyond which VOC-contaminated groundwater above aquifer cleanup standards will not be allowed to migrate. The compliance boundary for the central and eastern UAU areas of contamination is located approximately 2,000 feet south of Broadway Road, bounded by Price Road to the east and Dorsey Lane to the west. Sentinel wells will be located in the UAU upgradient of the UAU compliance boundary in an area bounded by Broadway Road to the north, approximately 1,000 feet south of Broadway Road to the south, approximately 1,000 feet east of Price Road to the east, and Dorsey Lane to the west. The location of the compliance boundaries and areas for sentinel wells are shown in Figure 10 in Section 10.0. The sentinel wells will be monitored at least quarterly for the hazardous substances for which aquifer cleanup standards are established (see Section 12.0), and for other substances as appropriate.

  The compliance boundary for the MAU areas of contamination is located approximately 2,000 feet east of the current extent of VOC contamination and is bounded by Rio Salado Parkway to the north and Apache Boulevard to the south. Sentinel wells will be located approximately 1,000 feet upgradient of the MAU compliance boundary, as shown in

[1] Public comments were received during the comment period concerning the discharge to SRP's Tempe Canal No. 6; EPA will consider these comments in determining the discharge end use during the remedial design.

Figure 10 in Section 10.0. The sentinel wells will be monitored at least quarterly for the substances for which cleanup standards are established and for other substances as appropriate.

- Continued monitoring of groundwater to verify the effectiveness of the extraction and treatment and MNA remedies and to ensure that aquifer cleanup goals are met throughout the areas of VOC contamination.
- Institutional controls to protect the public from exposure to contaminated groundwater exceeding aquifer cleanup levels until cleanup levels are met. Institutional controls will include various Arizona well siting, permitting, and construction restrictions, and notices distributed by the Arizona Department of Water Resources, Arizona Department of Health Services, or EPA concerning risks from exposure to contaminated groundwater. Additional institutional controls to prevent interference with EPA's remedial efforts also may be established.
- Sealing or abandonment of Well SRP23E, 2.9N to eliminate this potential path of VOC contaminant migration from the UAU to the MAU. This well is located in an area of shallow contamination and represents a potential conduit for downward contaminant migration. Other monitoring wells that will not be included in the long-term monitoring network will be abandoned as appropriate.

Contingency Remedy

A contingency remedy of extraction and treatment of appropriate target volumes of contaminated groundwater in MNA areas may be triggered to satisfy the following two criteria: (1) attaining aquifer cleanup standards within a reasonable time frame of approximately 30 years, and (2) preventing migration of groundwater contaminated above the aquifer cleanup standards to and beyond the compliance boundaries. The appropriate "target volume" of contaminated groundwater to be extracted and treated will be determined to ensure that these two criteria are met.

For the UAU or MAU, the contingency remedy will be triggered if either one of the following situations occurs:

(a) If verification sampling at the sentinel wells confirms that data collected during quarterly sampling exceed the aquifer cleanup standards, and if the average contaminant concentration collected from the next two consecutive quarterly sampling rounds from this well exceeds the aquifer cleanup standards, then the contingency remedy will be activated. The contingency remedy may be implemented sooner, if needed.

(b) EPA-approved flow and transport modeling will be conducted using data collected during each EPA 5-year review period. If the modeling evaluation indicates that the MNA remedy will not attain aquifer cleanup standards within a reasonable time frame of approximately 30 years from the start of remedial action, then the contingency remedy will be activated.

5. Statutory Determinations

The selected remedy and the contingency remedy for the Groundwater Operable Unit at IBW-South:

- Are protective of human health and the environment;
- Comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action;
- Are cost-effective;
- Use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable; and
- Satisfy the statutory preference for remedies that employ treatment that reduces the toxicity, mobility, or volume of contaminants as a principal element.

This remedial action is expected to take more than 5 years to achieve aquifer cleanup levels to allow for unlimited use and unrestricted exposure. Accordingly, by policy, EPA will perform a review not less than 5 years after completion of the construction for all remedial actions at the site, and may continue such reviews until EPA determines that hazardous substances have been reduced to levels protective of human health and the environment.

Keith A. Takata — 9-30-98

Keith A. Takata
Director of Superfund Division
U.S. Environmental Protection Agency, Region IX

Date

II. DECISION SUMMARY

II. Decision Summary

This Decision Summary summarizes the information and approaches used that led to EPA's decision on this remedy. It also establishes the remedy that EPA has selected. This ROD addresses remedial actions to be applied to the VOCs-in-Groundwater Operable Unit at IBW South. A ROD for VOCs in the Vadose Zone at IBW-South was issued in September 1993. Other RODs address various operable units (OUs) at the Indian Bend Wash Superfund Site-North (IBW-North) Site (See Section 3.1, Site History).

1.0 Site Summary

1.1 Site Name, Location, and Description

The Indian Bend Wash Superfund Site includes both North and South Study Areas. This ROD pertains only to the South Study Area. The two study areas, IBW-North and IBW-South, are divided approximately at the Salt River. The overall Indian Bend Wash Superfund Site comprises approximately 13 square miles and is bordered by Chaparral Road in Scottsdale on the north, Apache Boulevard on the south, Rural Road (in Tempe) and Scottsdale Road on the west, and Price Road (in Tempe) and Pima Road (in Scottsdale) on the east.

The IBW-South Study Area comprises approximately 3 square miles in the City of Tempe (COT), Arizona. Some portions of the site lie outside of Tempe in jurisdictional "islands" of Maricopa County. As shown on Figure 1, IBW-South is bounded by Apache Boulevard on the south, Rural/Scottsdale Road on the west, Price Road on the east, and is proximate to Curry Road on the north. IBW-South also includes the Salt River itself, which is ephemeral and flows during storm events and releases from Roosevelt Dam.

The site includes developed land for residential, commercial, and industrial uses. The area between Apache Boulevard and University Drive is primarily residential. North of University Drive, the site is largely retail and commercial, including light-industrial and auto repair/scrap facilities in the area south of the Salt River. The industry in the area includes circuit and electronics manufacturing, metal plating, plastics manufacturing, and dry cleaning.

1.2 Area and Topography

IBW-South encompasses Sections 13 and 14 and the northern halves of Sections 23 and 24, Township 1 North, Range 4 East. The total area of the IBW-South study area is approximately 3 square miles. The Indian Bend Wash is a desert wash that has been converted to a series of urban ponds linked by channels, and the wash meets the Salt River at the northern boundary of the IBW-South study area. The surface topography of the IBW-South area is generally flat. The IBW-South area is broken by buttes of rock and surrounded by mountains at the edges of the valley.

The surface ranges from 1,150 to 1,200 feet above mean sea level. Slopes do not generally exceed 2 percent. Slopes of over 100 percent exist only at the banks of the Salt River. IBW-South is located along the southwestern margin of the Paradise Valley trough.

1.3 Land Use and Demographics

The October 1994 zoning map for the City of Tempe indicates that the southern half of Section 13 is 91 percent industrial. Approximately 8 percent of the section is zoned for agriculture, with 1 percent for commercial developments. The agricultural zoning consists of open lots held for future development; currently no agricultural activities are taking place at the site. The northern half of Section 13 has undergone a number of physical changes over the past 20 years as a result of the ongoing mining of gravel along the southern edge of the Salt River.

A variety of businesses are engaged in various industrial processes within the southern half of Section 13, including manufacturing, reconditioning, metal plating, dry cleaning, and other activities. The majority of the facilities under investigation are within this area. VOCs and inorganic compounds were used by the businesses or were a result of their operations. Some of these compounds have been discharged into soils and groundwater in IBW-South. Contamination of groundwater resources has resulted from contaminant discharge, and the existing situation may pose a future threat to human health.

Seven known active or inactive landfills exist in the northern half of Section 13 along the Salt River. Many non-landfill-related businesses have operated or currently are operating on top of landfill material in this area. Therefore, it is possible that both the landfill material and the current businesses may have contributed to contamination at this portion of the site.

Current land use in Section 14 includes industrial, commercial, and recreational activities. The southern half of Section 14 is more than 70 percent industrialized because of the Arizona Public Service (APS) Ocotillo Power Plant. The remaining 30 percent consists of a commercial center, a golf course, and the Arizona State University (ASU) sports practice fields. The northern half of Section 14 is similar to the northern half of Section 13. Many changes have taken place because of gravel mining activities. Two known landfills flank Indian Bend Wash on the north bank of the Salt River; another landfill may exist on the south bank. A portion of the Karsten Golf Course is located in the northern half of Section 14.

The northern halves of Sections 23 and 24 are more than 80 percent residential in the form of apartments, condominiums, and single-family dwellings, occupied primarily by college students. The remaining 10 to 20 percent of land in these sections is light industrial and commercial developments such as restaurants, shops, and service stations.

Some demographics of IBW-South are listed below. The Statistical Report 1993 (City of Tempe, 1993) has a more complete compilation of census data specific to the City of Tempe.

The principal area of investigation within IBW-South lies in Sections 13 and 14. According to 1990 census information, Section 14 is strictly industrial and has a zero population. Section 13 has a population of 112, with most of the residents in this section living in mobile homes or trailers. The median age of the population in Section 13 is difficult to quantify

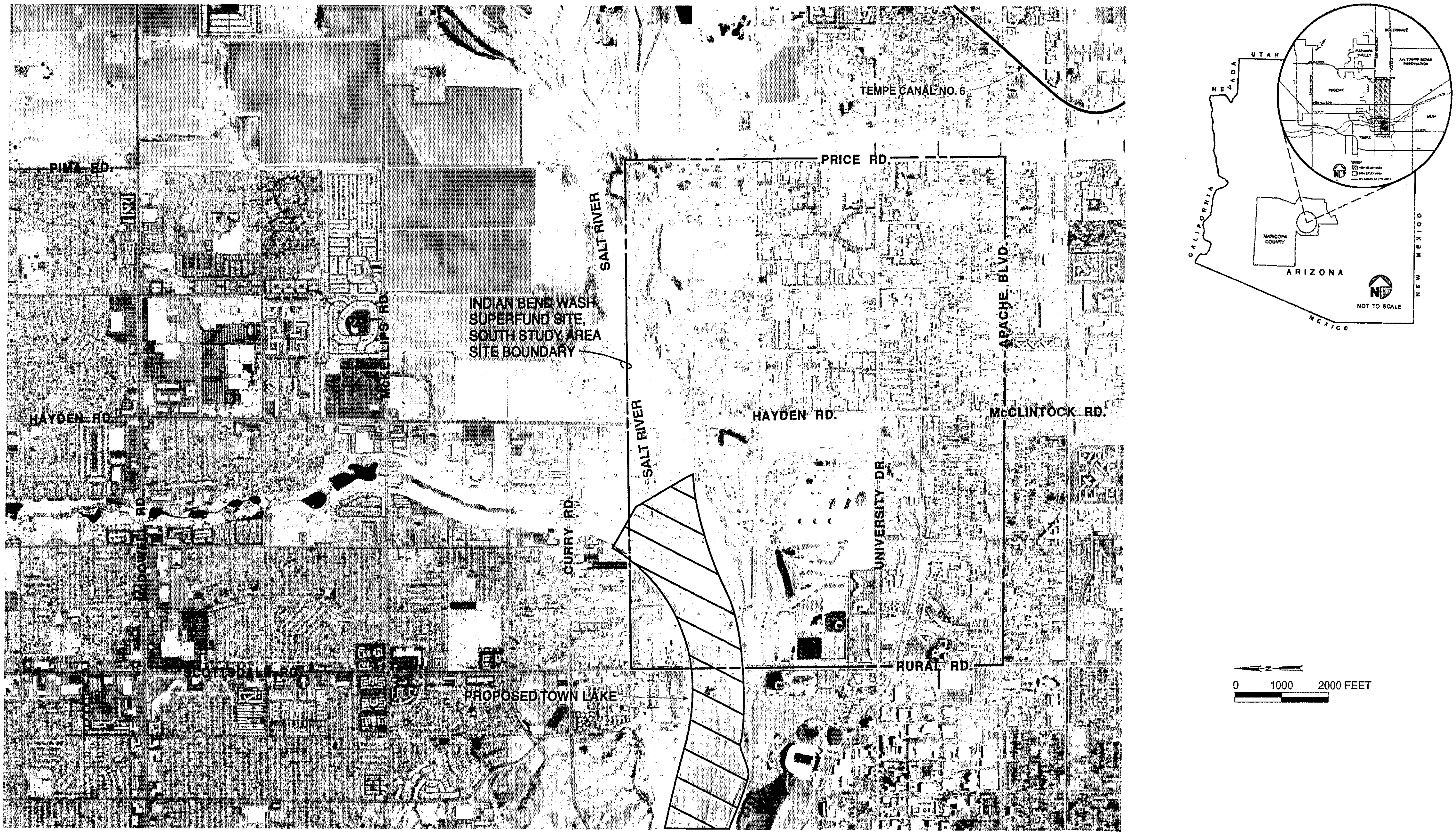

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FIGURE 1
SITE LOCATION MAP
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

because census figures combine populations by census tract numbers. In this case, Sections 11, 13, and 14 are considered one tract. The majority of the population resides in Section 11. Sixty-six percent of the population in this tract are between the ages of 18 and 59. Nearly 24 percent are under 17 years of age, and the remaining 10 percent are over 60 years of age.

Although only the northern halves of Sections 23 and 24 reside within IBW-South, available census data apply to the entire section. Section 23, with a population of 12,500, is adjacent to ASU and contains a large percentage of the off-campus housing available to resident students. Within Section 23, 86 percent of the population are between 18 and 59 years of age.

The Tempe 2000 General Plan Summary calls for more than 50 acres of land in the northeast corner of Section 23 to be rezoned as mixed use, with a park located within the center of the area. Currently, the area is zoned 90 percent industrial and 10 percent commercial. According to the City of Tempe Long-Range Planning Department, a portion of the mixed use area will be residential because all currently zoned residential areas have been developed.

Portions of the IBW-South are located within the 100-year floodplain of the Salt River.

1.4 General Surface-Water and Groundwater Resources

Surface Water

The Salt River is the primary surface-water body present within IBW-South. Also, two minor surface-water bodies exist within or near the boundaries of IBW-South. The Hayden Canal is a concrete-lined canal/underground pipeline used to distribute irrigation water by the SRP. The City of Mesa operates wastewater recharge ponds offsite from IBW-South to the northeast.

The Salt River flows only about 10 percent of the time, but its flow is unpredictable in any given year. Currently, the Salt River bed is mostly dry within IBW-South. Prior to the 1940s, the Salt River was a perennial stream providing water to the Phoenix area for irrigation and recreation. Following development of the SRP, the river became a dry riverbed for most of the year, flowing only in response to major rainfall. Over the years, sand and gravel extraction from the riverbed and floodplains and the creation of several landfills have dramatically altered the environment and habitat of the Salt River. In response to these developments, the Rio Salado Project was conceived to restore the Salt River through the creation of a series of lakes and streams over a length of 38 miles from Granite Reef Dam to the Gila River. The City of Tempe eventually assumed a leadership role in promoting the Rio Salado Project, focusing on the portion of the Salt River within the City boundaries. This portion of the Salt River restoration is referred to as the Rio Salado Town Lake Project, henceforth referred to as simply Town Lake.

Town Lake was conceived as a project to transform a portion of the dry Salt River bed into an urban lake to provide recreational opportunities and economic benefits. The proposed location of Town Lake near the IBW-South Study Area is shown on the Site Location Map (Figure 1). The 2-mile-long, 200-acre lake will be created by placing air-inflatable dams in the river channel to impound supplied water. The depth of the lake will vary from 6 feet at the upstream end to 19 feet at the downstream end. During seasonal flooding, the dams will be lowered to allow flood waters to pass downstream. When flooding stops, the dams will be raised to impound water for the lake once again.

The downstream dam will consist of a 16-foot-high rubber dam to control the water level in the lake. A smaller, 6-foot-high rubber dam at the upstream end will capture local river discharges and create a wetlands-type riparian enhancement zone while reducing the flow of surface-water pollutants into the lake.

Infiltration from the lake into the surrounding soils will be controlled by a combination of cutoff walls and groundwater extraction/recovery wells. Approximately 10 wells will be used along the upstream (eastern) portion of the lake (in the northwest portion of the IBW-South Study Area) to collect an estimated 20 to 30 million gallons per day (mgd) of infiltrated water and pump the water back into the lake.

A stormwater management system will be constructed to improve the water quality in the lake by reducing the inflow of potential pollutants and contaminants. Stormwater diversions will capture and bypass the "first flush" from several major stormwater discharges to a point either upstream or downstream of the lake. In addition, detention areas will be provided to reduce the potential for spills from the Red Mountain Freeway from entering the lake.

Construction of Town Lake began in late 1997 and is scheduled to be completed in 1999.

Groundwater Resources

Groundwater at IBW-South was used as a drinking water source until contamination was discovered in two wells owned by the City of Tempe. These wells have not served water since 1989; however, one well, COT No. 7, was used once as a backup emergency potable supply.

Currently, the aquifer is used for industrial and agricultural purposes. The largest industrial use is for cooling water by the APS Ocotillo Power Plant.

2.0 Geology and Hydrogeology

This section describes the geology and hydrogeology for the Groundwater Operable Unit at IBW-South.

2.1 Stratigraphy

The materials at the IBW-South site are primarily a thick basin-fill sequence of alluvial sediments derived from surrounding mountains. Igneous rocks may intrude in places, and a crystalline bedrock exists in juxtaposition to the alluvial units as a result of block faulting.

2.2 Geology/Stratigraphy

The complex geological formations underlying IBW-South are generally divided into three layers, designated as alluvial units. Portions of the alluvial units that can store and transmit significant quantities of groundwater are called aquifers. In general, three main alluvial units underlie the IBW-South site: upper, middle, and lower (UAU, MAU, and LAU, respectively). A conceptual geologic cross section is shown on Figure 2. In some locations, the LAU is underlain by the Red Unit, which consists of cemented sands, gravel, and clays.

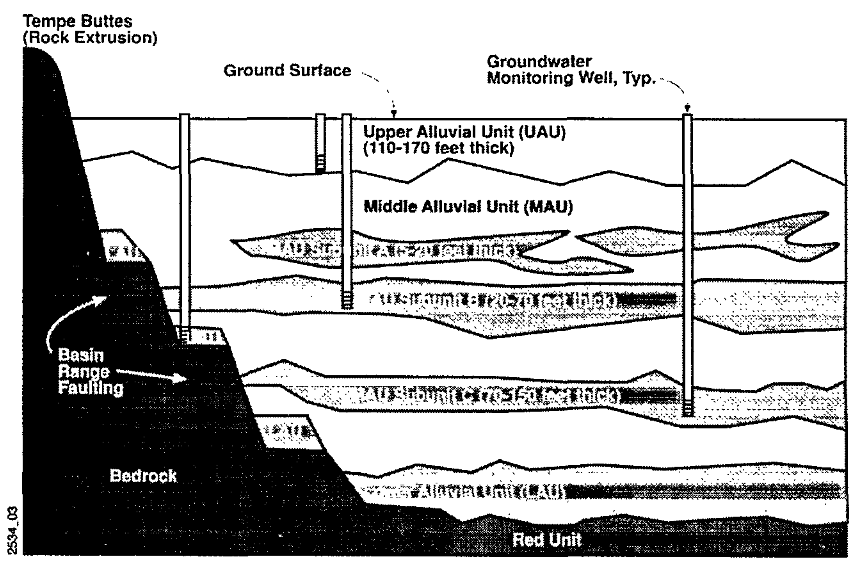


FIGURE 2
CONCEPTUAL GEOLOGIC CROSS SECTION
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

Upper Alluvial Unit

The UAU is distributed across the entire IBW-South study area, and generally has a uniform thickness. The UAU typically is found near or at the ground surface and extends to approximately 110 to 170 feet below ground surface (bgs). The UAU is normally divided into an upper layer of clay and sandy silt and a lower layer dominated by sand, gravel, cobbles, and boulders. The upper layer is typically not present near the Salt River channel, and thickens to more than 20 feet south of the channel.

Transmissivity data for the UAU have been gathered through 36 aquifer tests performed on UAU wells at the site to date. The estimated transmissivity values varied widely from a low of 1,900 square feet per day (ft^2/day) to a high of 73,000 ft^2/day. The range of transmissivities corresponds to hydraulic conductivity values between approximately 30 feet per day (ft/day) and 1,000 ft/day. The results of these tests suggest that no clear spatial trend in transmissivity values can be identified; however, the values obtained appear to be log-normally distributed. This suggests that calculating the geometric mean of the transmissivity values is an appropriate method by which to obtain an average value for the data set. The geometric mean of the UAU transmissivity values is approximately 17,000 ft^2/day.

Middle Alluvial Unit

The MAU consists primarily of clay and sandy silt with significant interbedded layers of sand-gravel mixtures. These coarser-grained interbedded layers generally represent the zones with higher hydraulic conductivity in the MAU. Weak to strong calcium carbonate cementation is also present in the MAU.

The interbedded stratigraphy encountered within the MAU is subdivided into three subunits described below:

- **MAU Subunit A**–Ranges in thickness from 5 to 20 feet and is typically found between 170 to 200 feet bgs. Sand, cemented sand, and silty sand dominate the composition of Subunit A. This subunit tends to be laterally discontinuous and is frequently not encountered in the study area.
- **MAU Subunit B**–Ranges in thickness from 20 to 70 feet and is typically found between 250 and 300 feet bgs. Sand, gravel, and silty sand dominate the composition of MAU Subunit B. MAU Subunit B appears to have the widest extent of all the MAU subunits within the IBW-South study area.
- **MAU Subunit C**–Ranges in thickness from 70 to 150 feet and is typically found between 380 and 550 feet bgs. Sand, gravel, and silty sand dominate the composition of MAU Subunit C.

Aquifer tests have been performed on five monitoring wells screened in MAU Subunit B, and seven wells screened in MAU Subunit C. Transmissivities estimated from the MAU Subunit B tests range from 1,000 to 12,500 ft^2/day. This corresponds to a range of hydraulic conductivities of between 5 ft/day and 250 ft/day. Results from the MAU Subunit C aquifer tests suggest a range of transmissivities between 2,500 and 11,000 ft^2/day. These values correspond to a range of hydraulic conductivities from 45 ft/day to 500 ft/day.

Lower Alluvial Unit

The LAU underlies the MAU and, for most of the study area, exceeds the depths explored during the remedial investigation (RI). The LAU was first encountered at 500 feet bgs in Well SIBW-12L, and the base of the LAU was typically not encountered. Observations of the LAU indicate that the composition of the LAU is a conglomerate, dominated by weakly cemented gravel, sand, silt, and rock fragments. The aquifer test performed in Well SIBW-12L suggests that the transmissivity of the LAU is significantly lower than the other units with a value between 100 and 200 ft^2/day. These data suggest a hydraulic conductivity for the LAU of about 5 ft/day.

Red Unit

The Red Unit is the deepest of the alluvial units, and comprises a wide range of Tertiary sediments with a reddish-brown color and distinctive cementation.

Groundwater is expected to flow through the Red Unit as a continuous porous medium with enhanced flow potential where it has been fractured and faulted. However, the Red Unit was not investigated during the IBW-South RI and is not expected to have a significant role in the movement and distribution of contamination within the study area.

2.3 Groundwater Movement

The following sections provide summary descriptions of the movement of groundwater in the UAU, MAU, and LAU. Groundwater elevations for the UAU measured in October 1994 are shown on Figure 3; groundwater elevations for the MAU and LAU measured in October 1994 are shown on Figure 4. These figures and the text below were presented in the RI. Data collected since the RI support the conclusions presented below.

Groundwater Movement—Upper Alluvial Unit

The following list summarizes conclusions regarding groundwater movement in the UAU within the study area:

- Groundwater flow directions in the UAU are south to southwest during non-riverflow conditions in the Salt River. These flow directions shift to south to southeast during riverflow conditions in the Salt River when recharge influences groundwater flow directions.

- Groundwater flow through the UAU originates mainly from Salt River recharge (during flow events) and lateral inflow moves vertically downward, eventually entering the MAU.

- The horizontal gradient in the UAU ranges from 0.0015 to 0.004 foot per foot (ft/ft) during non-riverflow conditions in the Salt River. Salt River recharge during riverflow conditions increases the horizontal gradient to 0.006 to 0.012 ft/ft.

- The vertical gradient from the UAU to the MAU is downward throughout the study area and ranges from 0.15 ft/ft to 0.20 ft/ft without influence from Salt River flows. This downward gradient can increase to as high as 0.27 ft/ft during and directly following riverflow events.

- The Salt River does not function as a groundwater divide during non-riverflow conditions when the river is dry, but becomes a groundwater divide during riverflow events.

- No evidence exists to suggest that groundwater contamination originating from IBW-North has been transmitted to IBW-South, regardless of riverflow conditions.

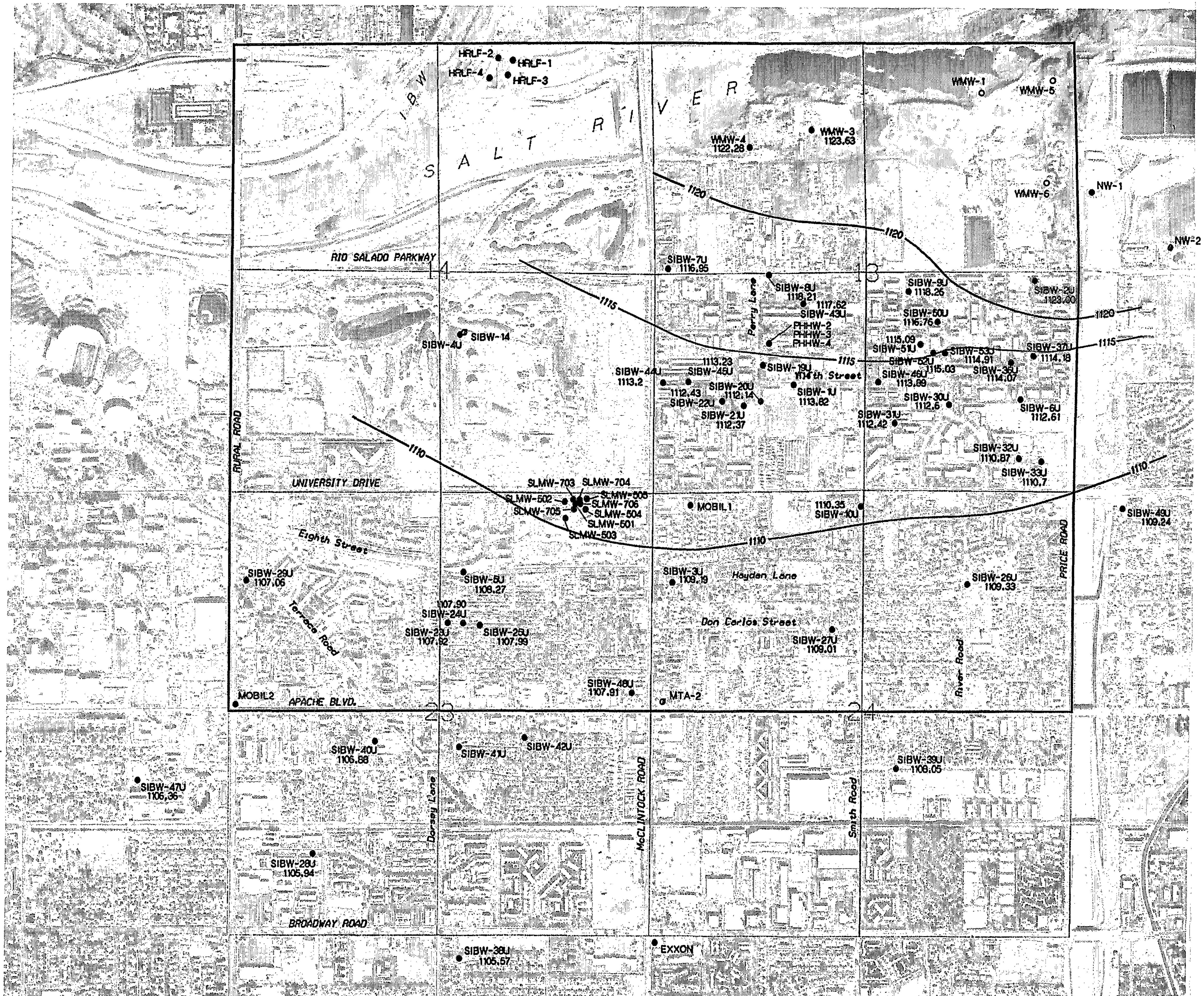
The following list summarizes conclusions regarding groundwater movement in the MAU and LAU. MAU Subunit A is not included in this discussion because in this area it is very thin and discontinuous. Consequently, no EPA wells are screened in this subunit:

- The groundwater flow direction in MAU Subunit B is generally west to east, but insufficient data exist to fully characterize the flow direction. The groundwater flow direction in MAU Subunit C varies from due north to east, with northeast appearing to be the predominant flow direction.

- According to limited data, the horizontal gradient in MAU Subunit B appears to be approximately 0.001 ft/ft. The horizontal gradient in MAU Subunit C ranges from 0.002 to 0.004 ft/ft.

- The vertical gradient from MAU Subunit B to MAU Subunit C is downward across the study area and ranges from 0.02 to 0.13 ft/ft. Salt River flows do not appear to directly influence vertical gradients from MAU Subunit B to MAU Subunit C.

- Limited data exist to estimate groundwater flow directions in the LAU. The general flow direction is to the east or northeast, similar to the MAU.



LEGEND

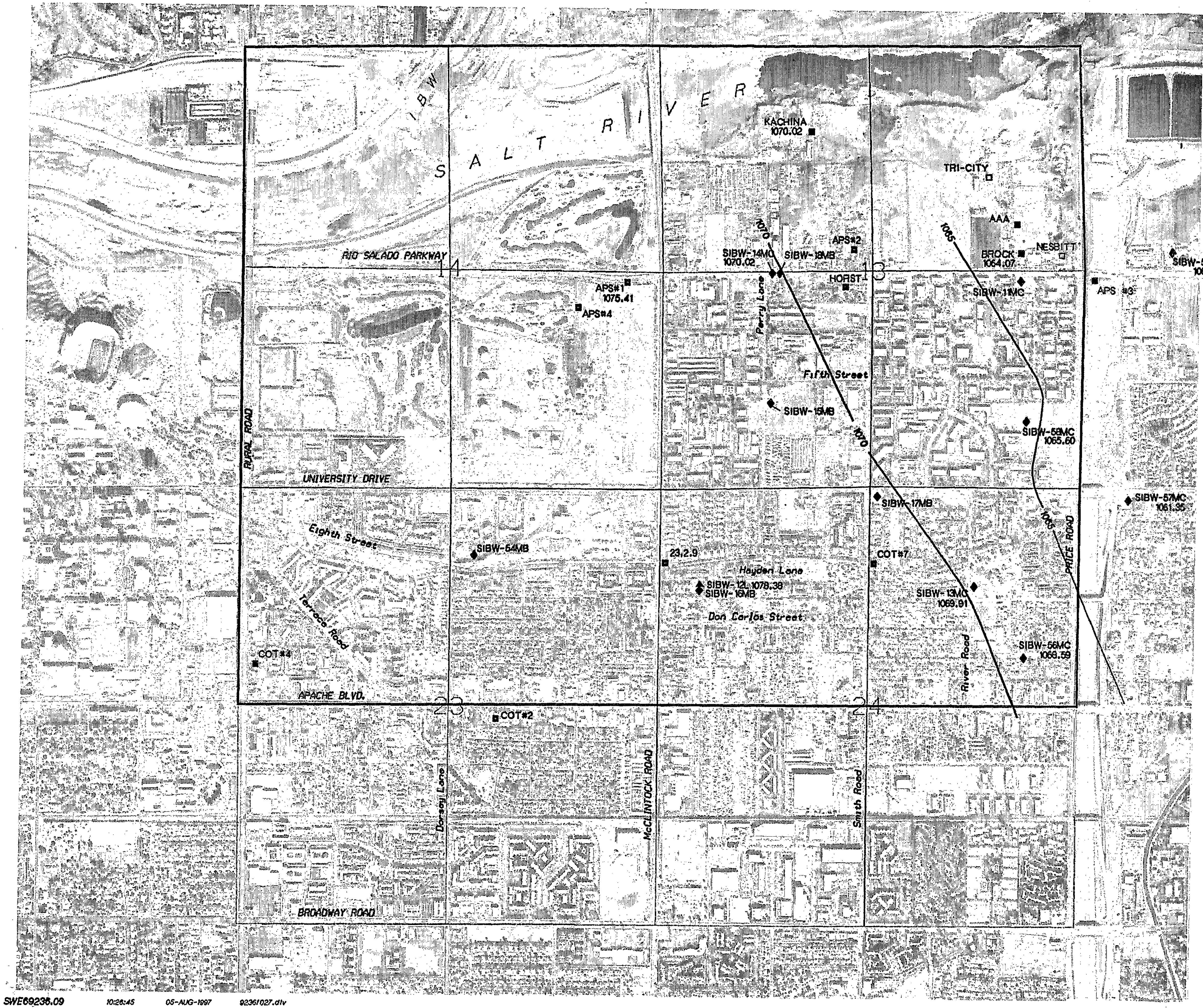
- ● UAU WELLS
- ○ ABANDONED UAU WELLS
- ⌀ TEST HOLES

N

600 0 600 1200
SCALE 1"=1200'

FIGURE 3
CONTOURS OF EQUAL GROUNDWATER ELEVATION IN UAU WELLS, OCTOBER 1994
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

SWE69236.09 10:25:35 05-AUG-1997 92361025.dlv



LEGEND

- ◆ MAU WELLS
- ▲ LAU WELLS
- ■ PRODUCTION WELLS
- □ ABANDONED PRODUCTION WELLS

SIBW-16MB WELL NAME
1081.93 GROUNDWATER ELEVATION

N

600 0 600 1200
SCALE 1"=1200'

FIGURE 4
GROUNDWATER ELEVATIONS IN MAU C AND LAU WELLS, OCTOBER 1994
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

SWE69236.09 10:26:45 05-AUG-1997 92361027.dlv

3.0 Site History and Enforcement Activities

3.1 Site History

Site Discovery and RODs Issued

In 1981, the City of Phoenix sampled water from several wells in Scottsdale and detected VOC contamination. These wells were subsequently taken out of service to protect public health. In 1982, EPA sampled 20 wells belonging to the SRP and the cities of Phoenix, Scottsdale, and Tempe. Chemical analyses determined that 11 of the 20 wells were contaminated with VOCs, and these wells were also shut down. Subsequently, groundwater contamination was detected in wells located in the northern part of Tempe, and these wells were shut down as well. Information from the City of Tempe indicated that COT No. 7 has been used extremely rarely as backup emergency potable water supply wells (once since 1990).

Following the discovery of groundwater contamination in the area, EPA established the Indian Bend Wash Superfund Site on the National Priorities List (NPL) in September 1983. Since that time, EPA has conducted several investigations to determine the nature and extent of soil and groundwater contamination at the site. These investigations concluded that the VOCs of primary concern included TCE; 1,1,1-TCA; 1,1- and 1,2-dichloroethene (1,1- and 1,2-DCE); and PCE. The contamination in IBW-North was found to have originated from a limited number of larger industrial facilities. Conversely, within the IBW-South Study Area, the groundwater contamination appears to have had several sources, from mid-size industrial facilities to small privately owned businesses.

At the beginning of the Superfund remedial investigations in 1984, higher levels of contamination were detected at IBW-North (Scottsdale) than were detected at IBW-South (Tempe). Therefore, EPA allocated more resources to address the greater potential health risk posed at IBW-North, given the limited information available at that time. At the end of 1987, EPA informally split the overall IBW Study Area into the IBW-North and IBW-South areas for more efficient management. This ROD does not address remedial action for IBW-North.

IBW-South has been divided into two OUs, soil and groundwater, in accordance with NCP § 300.430(a)(1)(ii)(A). For IBW-South, EPA issued a ROD for the operable unit pertaining to VOCs in soils in 1993. That ROD established criteria for determining whether soils at a particular location might contribute to future groundwater contamination or public health risk, and selected soil vapor extraction (SVE) as the remedy when those criteria are met. Focused RIs have been and are being performed to determine which subsites would meet, or "plug-in" to, those criteria for potential future contribution to groundwater contamination. If a subsite or property "plugs in," EPA will issue a "Plug-In Determination" for that subsite or facility calling for the SVE remedy.

To date, one Plug-in Determination has been made for the former DCE Circuits subsite, and an SVE system has been constructed and is currently in operation. Focused RI work is continuing at other subsites within IBW-South, and EPA expects to complete the Plug-In Determinations for those subsites once the Focused RI work is complete.

3.2 IBW-South Remedial Investigation for Groundwater

In 1988, EPA began more intensive investigation of contamination in IBW-South after addressing the higher potential risk contamination in IBW-North. The data available at the time indicated that the concentrations of VOCs in groundwater were much lower in IBW-South than in IBW-North, but were still above drinking water standards. All known contaminated groundwater production wells in IBW-South had been shut down to prevent exposures to groundwater contaminated above drinking water standards.

EPA's RI for IBW-South achieved two objectives:

- Performed soil and source investigations; and
- Performed a regional groundwater investigation.

During the source investigations, soil and soil gas sampling were conducted at the facilities representing potential sources of groundwater contamination. A source investigation was conducted at each facility. The facilities investigated during the RI are shown on Figure 5. Preliminary evaluation of data collected during soil gas investigations has resulted in the delineation of eight "subsites" at IBW-South. EPA and ADEQ may refine and further delineate subsite areas that might need further investigation. The source investigation, combined with the regional groundwater investigation, showed that the groundwater contamination at IBW-North did not originate at IBW-South, and vice versa.

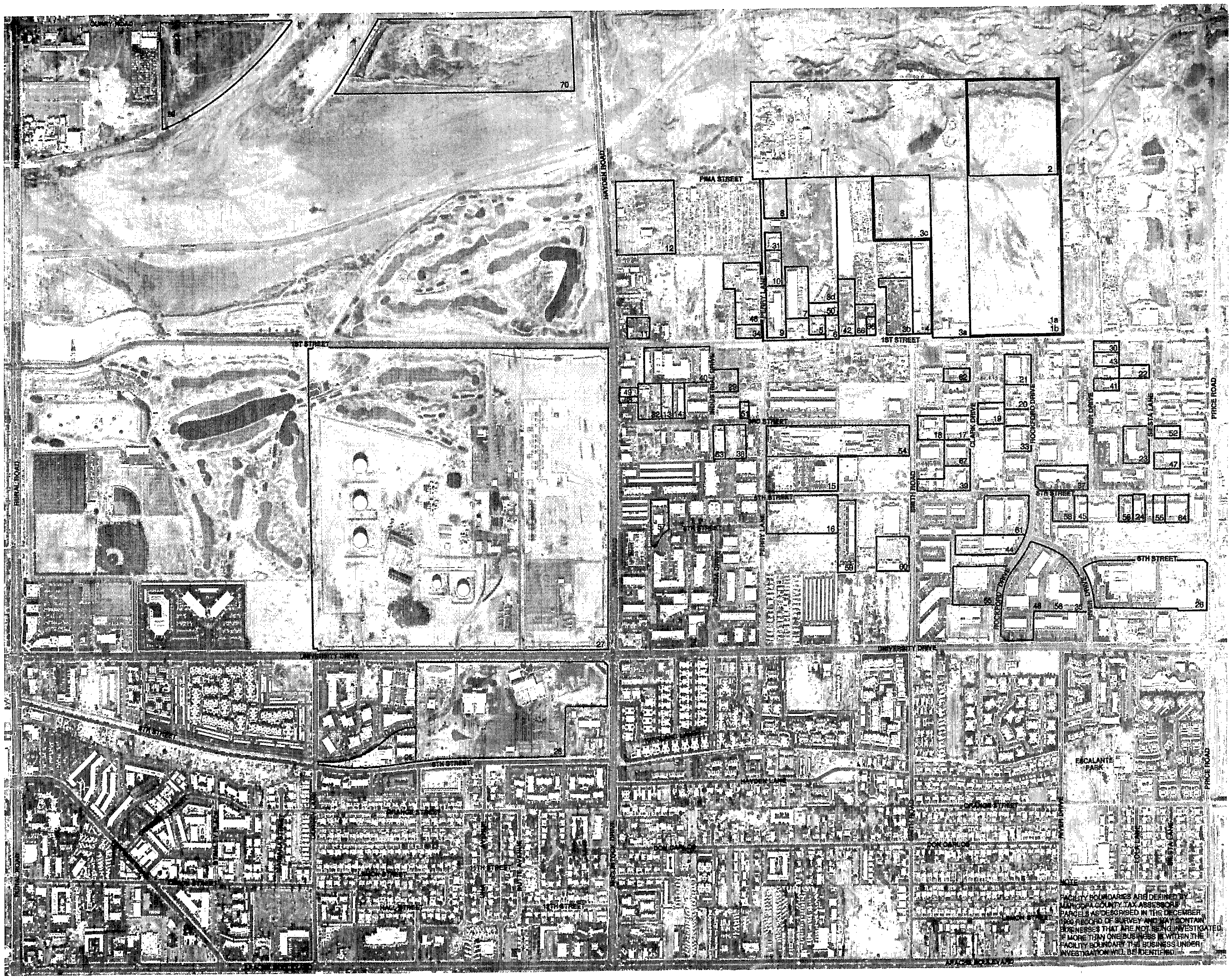
The regional groundwater investigation examined the overall presence of contaminants in groundwater and the movement of groundwater across the entire site. Contamination in the soil or soil gas at a facility can migrate downward and enter groundwater. Once in groundwater, it can flow away from the facility and become more widespread or a potential regional problem. The regional groundwater investigation therefore recognized individual sources, but adopted a regional perspective on contaminant movement.

Soil, soil gas, and groundwater data and interpretations were collectively incorporated into the Final RI Report (EPA, 1997).

3.3 Enforcement Actions

Groundwater

In December 1997 and January 1998, EPA issued general notice letters specifically for the groundwater contamination at IBW-South. These general notice letters were sent to approximately 14 parties associated with 6 facilities or subsites believed to be sources of groundwater contamination at IBW-South. The majority of these parties had already received general notice letters from EPA between 1988 and 1993. EPA will continue to identify potentially responsible parties (PRPs) should additional information come to light.



LEGEND

A1 FIBERGLASS	36
ALLSTATE MINE SUPPLY, INC.	5
ALMAR INDUSTRIES	37
APS OCOTILLO POWER PLANT	27
ARIZONA BRONZE	32
ARIZONA CASTINGS, INC.	10
ARIZONA CIRCUITS	33
ARIZONA ELECTRICAL	38
ARIZONA INTEGRATED ELECTRONICS	39
ARIZONA JACOBSEN PLASTICS CO.	40
ARIZONA MOTORCYCLE SALVAGE, INC.	11
ARIZONA PNEUMATIC	41
BENJAMIN SUPPLY AND MANUFACTURING	42
BENNETT BROTHERS RECYCLING	3b
BIOMIN LABORATORIES	43
CERPROBE CORP.	44
CIRCUIT EXPRESS/MEGATRONICS/ECM	24
CIRCUIT TECHNOLOGY	29
DCE CIRCUITS	25
DESERT SPORTSWEAR	17
ELDON DRAPERY	13
FIRST STREET LANDFILL	1a
FORMER CRAVENS MARTIN DESIGN	23
FORMER MEGATRONICS @ 229 S.CLARK	19
FORMER QUARTZ ENGINEERING	21
GREAT WESTERN MINING	9
GS INDUSTRIES	45
HERSETH ENTERPRISES	46
IMC MAGNETICS @ MURPHY CLAN PROPERTY	16
IMC MAGNETICS	15
INTERLOCKING PAVING STONES/ B & M AUTO WRECKING	12
JONES MEDICAL LAB (JMI PHOENIX LAB INC.)	47
JORIGA ELECTRONICS	48
K&K TRANSMISSION	7
KACHINA LANDFILL	1b
KACHINA REDI-MIX	3c
LAMBERT & SON AUTOBODY	49
M&H ELECTRIC	50
M&M AIR CONDITIONING (BRODERICK REFRIGERATION)	51
MAPEI	18
MARDON INDUSTRIES	52
MARICOPA COUNTY LANDFILL	3d
MIRACHEM CORP.	53
OLD TEMPE LANDFILL	2
PALM HARBOR HOMES, INC.	54
PIMA PERRY PARTNERS	8
PINNACLE MANUFACTURING	55
PLASTIC INJECTION MOLDERS	56
PLEKO SOUTHWEST INC.	57
PRECISE MANUFACTURING	58
PRESTIGE DRAPERY SERVICE	22
REDI-STRIP OF PHOENIX	30
RELTEC CIRCUITS	59
ROADWAY EXPRESS, INC.	60
ROCKFORD CORP.	61
ROWAN PROPERTY	6
RRCA LANDFILL	3a
RURAL METRO CORP.	4
SALT RIVER MARINE	34
SCHMID TOOL AND MOLD	62
SERVICE AND SALES, INC.	63
SILVER STREAK, INC.	14
SOUTHWEST MOLD/SOUTHWEST THERMOPLASTICS	64
SRP-75 LANDFILL	69
SRP-78 LANDFILL (HAYDEN ROAD)	70
SUPERLITE BLOCK	28
SYSTEM SPECIALISTS	35
TECH MEDICAL, A DIV. OF TECH PLASTICS, INC.	65
TEMPE TRANSMISSION EXCHANGE	66
UNITOG/PRESTIGE APPAREL	20
VARIAN	26
WHITRONICS	31
XYTEC CORP.	67
ZEMUN INDUSTRIES	68

N

400 0 400 800 FEET

FIGURE 5
FACILITY LOCATIONS
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

Soil

EPA issued four Unilateral Administrative Orders (UAOs) under CERCLA §106 and one Administrative Order on Consent (AOC) under CERCLA §122 to PRPs to obtain Focused RIs for soil contamination and to install groundwater monitoring wells that would be included in the overall IBW-South regional groundwater investigation. The orders issued are shown in Table 1.

TABLE 1
Orders Issued for Focused RI Work at IBW-South

Facility	Order Type	Respondents
DCE Circuits (former operator)	UAO	VAFCO (Rudy Vafadari, et al.); Arden Properties
IMC Magnetics	UAO	IMC Magnetics, Arizona Division, Inc.
Prestige Cleaners, Inc.	UAO	Prestige Cleaners, Inc.
Eldon Drapery	UAO	Leibovitz Enterprises Limited Partnership; Y&S, Inc.
Unitog Rental Services	AOC	Unitog Rental Services, Inc.

UAO = Unilateral Administrative Order
AOC = Administrative Order on Consent

EPA is continuing its investigation of potential source areas, and at this time, EPA estimates that approximately eight subsites may be contributing or have contributed VOCs to the environment within the IBW-South study area. These subsites may consist of one or more facilities or properties. These eight subsites are identified in the final RI report for IBW-South (EPA, 1997). The results of the final investigations of these subsites will be presented in Focused RI reports as explained in the ROD issued in September 1993 regarding the VOCs in the Vadose Zone.

EPA has issued information request letters pursuant to CERCLA §104(e) to more than 100 parties within IBW-South. These letters request information about solvent usage and other practices of operation; waste handling and disposal; spills; the presence of tanks, dry wells, drains, leach lines and degreasers; and related matters. EPA used this information to assist in identifying potential sources of VOC contamination.

In 1988 and 1990, EPA issued general notice letters to approximately 30 parties. In June 1993, EPA issued a second general notice letter to about 65 parties informing them of potential liability. Some of the 65 parties who received this notice had also received the original general notice in 1988 or 1990. In addition, EPA has sent approximately 12 letters to parties informing them that unless further data or information becomes available, EPA does not plan to conduct further investigation at their facility and/or property. These 12 parties had previously received general notice letters from EPA.

As EPA identifies which subsites are sources and which facilities will warrant remedial action activities, EPA will continue to gather information to identify those PRPs related to these subsites. As a result of identifying PRPs related to these subsites, EPA may issue additional general notice letters to parties currently associated with these subsites if they have not already received notice from EPA.

4.0 Highlights of Community Participation

Because the IBW-South and IBW-North study areas are part of one overall IBW site, EPA has joined community relations planning and execution for both areas. The Community Relations Program therefore addresses the IBW community as a whole, although a given fact sheet or meeting usually pertains specifically to only one study area.

EPA currently maintains IBW-South information repositories at EPA Region IX Office in San Francisco, and at the Scottsdale, Tempe, and Phoenix Public Libraries. EPA Region IX Office and the Tempe and Scottsdale Public Libraries maintain copies of the Administrative Record file on microfilm; the Phoenix Public Library maintains a collection of selected key documents, including the Interim and Final Remedial Investigation reports, the Feasibility Study (FS), the Proposed Plan, and this ROD. In addition, ADEQ maintains an information repository, with various key documents, in its Phoenix office. EPA also maintains a computerized mailing list database for all of Indian Bend Wash. This list currently contains more than 1,700 addresses. In addition to continually updating the mailing list, EPA sent a fact sheet in December 1990 to approximately 35,000 addresses in the area of the Indian Bend Wash Superfund site in an effort to expand the list. This fact sheet (and all EPA fact sheets for IBW-South) provided a return coupon and telephone numbers that one could use to be placed on the mailing list.

EPA also operates a toll-free information message line (800/231-3075) to enable interested community members to call EPA with questions or concerns about Indian Bend Wash Superfund site activities. The message line is publicized through newspaper notices and the mailing list. EPA has been responding to numerous inquiries about the effects of potential Superfund liability upon residential and small business property located within or near the study area boundaries. Some of these concerns are addressed in the Responsiveness Summary of this ROD.

Table 2 presents a chronological list of other community relations activities that EPA has conducted for IBW-South to ensure community involvement and to comply with the public participation requirements of CERCLA §113(k)(2)(B) and CERCLA §117. Activities that were specific to IBW-North only are excluded from this list.

This ROD presents the selected remedy for the groundwater OU for IBW-South, chosen in accordance with CERCLA, amended by SARA, and, to the extent practicable, the NCP. The decision for IBW-South is based on the Administrative Record, which is available to the public.

TABLE 2
IBW-South Community Participation Highlights

September 1984	Released a community relations plan based upon interviews with Phoenix, Scottsdale, and Tempe residents and state and local officials.
1984 through1988	During this period, community relations activities addressed all interested persons in the IBW community, but information transfer centered on IBW-North.
December 1990	Distributed a fact sheet to all persons on the mailing list providing information on IBW-South and groundwater monitoring and soils investigations.
Throughout 1991	Distributed a flyer to residents near EPA's well drilling activities throughout the study area, which explained the reason for, and nature and context of, the well drilling.
May 1991	Distributed a flyer and held a public meeting to update the community on the findings of the remedial investigation, the type of contamination, movements of groundwater, the potential sources, and EPA's remedial and enforcement strategies; addressed community questions and concerns.
January 1992	Updated the 1984 community relations plan to reflect new site communication strategies and information from residents, officials, and other members of the community.
September 1992	Distributed a fact sheet providing information about investigation activities and Administrative Orders that had been issued, and also announcing a public comment period on a Contingency Plan for Removal of Landfill Materials, which the Arizona Department of Transportation (ADOT) was proposing as part of its work under its agreement with EPA. Held a 30-day public comment period on this issue.
December 1992	Issued a flyer to residents in a surrounding neighborhood of the former DCE Circuits facility where EPA was beginning fieldwork as part of a Focused Remedial Investigation. Flyer explained the reason for, and nature and context of, the activities and gave contact names.
April 1993	Distributed a fact sheet updating the community on activities at IBW-South, including Administrative Orders, groundwater, and an initial description of the Plug-in Approach to be used in the upcoming VOCs-in-Vadose-Zone remedy.
May 1993	Issued a flyer to residents affected by EPA's well drilling activities informing them of the reason for, and nature and context of, the activities.
June 1993	Mailed IBW-South Administrative Record file on microfilm for the Soils ROD and including groundwater information to Scottsdale and Tempe Public Libraries. Hard copies of the IBW-South IRI Report were sent to these libraries and the Phoenix Public Library.
June 1993	Held informal meetings with citizens and PRP groups to present EPA's proposal for VOCs-in-Vadose-Zone remedy and to answer questions and concerns.
June 7, 1993	Distributed the Proposed Plan Fact sheet for the VOCs-in-Vadose-Zone remedy to all persons on the mailing list, to local officials, the state, and to libraries, announcing EPA's proposal for the soils remedy, the comment period, the scheduled public meeting and open house session, and the availability of the Administrative Record file.
June 9, 1993	Issued press releases to the Scottsdale, Tempe, and Phoenix media about the proposed VOCs-in-Vadose-Zone remedy, the scheduled public comment period and open house session, and the availability of the Administrative Record file.

TABLE 2
IBW-South Community Participation Highlights

July 1993	Held an open house session at Gililland Jr. High School in Tempe to present EPA's proposed remedy for VOCs in the Vadose Zone.
July 1993	Extended Public Comment period to August 14, 1993, on VOCs-in-Vadose-Zone remedy.
July 7, 1993	Held a formal public meeting at Gililland Middle School in Tempe, from 7-10 PM, to present EPA's proposed remedy for VOCs in the Vadose Zone, answer questions, and to receive written and oral public comments; all proceedings were recorded and the transcript made part of the Administrative Record file.
August 1996	Issued fact sheet on SVE at the DCE Circuits Site.
September 1997	Issued Proposed Plan for cleanup of contaminated groundwater at the IBW-South Site.
September 1997	Mailed the Administrative Record file for the Groundwater OU remedy to the Scottsdale and Tempe Public Libraries.
September 24, 1997	Held a formal public meeting on Proposed Plan for groundwater remediation held at Gilliland Middle School, Tempe, AZ. The Public Comment Period was set for September 15 to October 14, 1997.
October 1997	Extended Public Comment Period to November 28, 1997, on the Proposed Plan for groundwater cleanup.
February 1998	Held meeting with PRPs and ADEQ to further discuss PRP comments and concerns regarding the Proposed Plan.
May 1998	Met with PRPs to describe additional groundwater data collected and modeling performed since the Groundwater FS cutoff date for data inclusion.
June 1998	Met with City of Tempe for a tour of the Rio Salado Town Lake Project and presented and discussed the additional data and modeling performed since the Groundwater FS cutoff date for data inclusion.
August 1998	Met with stakeholders to describe the ROD contingency plans for the MNA portions of the remedy.

5.0 Scope and Role of Operable Units

This ROD addresses VOC groundwater contamination at IBW-South, and is known as the VOCs in Groundwater Operable Unit ROD. EPA has already addressed VOC contamination in the vadose zone for the soil operable unit at IBW-South in a ROD issued in September 1993. As described in Section 3.1, the Soil OU ROD provides a presumptive remedy of SVE for soil remediation at IBW-South and a set of decision criteria to determine whether a particular subsite meets or "plugs in" to the ROD. One Plug-In Determination has been made to date, and other subsites are in various stages of characterization. The overall final remedy for the IBW-South Area encompasses both RODs for VOCs in soil and groundwater OUs.

EPA's vadose zone OU remedy addresses VOC contaminants in the vadose zone which could migrate to groundwater. That ROD does not address non-VOC contaminants that may be in soils, such as metals. That vadose zone OU remedy, in combination with the active treatment portions of this groundwater remedy, addresses the principal threats posed by VOCs at IBW-South through treatment. Where necessary, EPA will use removal actions, or select other remedies for such contaminants, or modify this or the Vadose Zone OU remedy to address them with an amendment or an explanation of significant differences (ESD).

To ensure that aquifer cleanup standards are met within a reasonable time frame of 30 years and to limit migration of contaminated areas where MNA is the selected remedy, EPA has established a contingency remedy for groundwater. The contingency remedy is extraction and treatment of a "target volume" that is necessary to meet the performance standards. The criteria that will trigger the contingency remedy and the target volume are discussed in Section 11.0 and throughout this ROD.

6.0 Summary of Site Characteristics

This section summarizes the current extent of VOC contamination at IBW-South, and describes the pathways for contaminant migration. Actual routes of exposure and exposure pathways are discussed in Section 7.0.

Over 50 monitoring wells have been installed at IBW-South. Groundwater contamination has been evaluated according to the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). The most consistently detected VOC contaminants in the groundwater are TCE and PCE. The MCLs for both TCE and PCE are 5 micrograms per liter (μg/L). This summary descripton focuses on the two main COCs, PCE and TCE; other VOC contaminants are addressed in the RI.

The RI was conducted over a period of many years, and IRI reports were published in 1991 and 1993. The final RI, published in 1997, presented the following information on groundwater contamination at IBW-South, herein updated to reflect the most current validated groundwater sampling results (April 1998).

6.1 Extent of Contamination

Upper Alluvial Unit

Contamination in the UAU is estimated to form approximately three contaminated areas referred to as the western, central, and eastern contaminated areas, as shown on Figure 6 and described below:

- *Western area of contamination.* The highest levels of VOC contamination at IBW-South have been detected here. The contamination consists mainly of TCE and PCE occurring throughout the contaminated area. This area is partially defined, from northeast to southwest, by Wells SIBW-5U, SIBW-23U, SIBW-24U, SIBW-40U, and SIBW-28U. Groundwater contaminated with TCE exists in the vicinity of the DCE Circuits facility and is moving southwest with the prevailing groundwater flow direction. TCE concentrations have been detected as high as 540 μg/L in Well SIBW-5U. The downgradient edge of this contaminated area is undefined to the southwest of Well SIBW-28U. TCE concentrations have decreased in SIBW-5U since 1991. The highest TCE concentration observed between 1994 and 1996 was 90 μg/L in SIBW-5U in October 1994. The TCE concentration in SIBW-5U has decreased to less than 5 μg/L in 1998. Analytical results of samples collected from the farthest downgradient well, SIBW-28U, indicate TCE concentrations have increased from 20 μg/L in October 1994 to 43 μg/L in April 1998.

- *Central area of contamination.* A second, central area of PCE- and TCE-contaminated groundwater is found in the vicinity of the IMC Magnetics, Inc., facility. This area is partially defined, from northeast to southwest, by Wells PHHW-2, SIBW-21U, SIBW-3U, and SIBW-48U. TCE concentrations of up to approximately 53 μg/L have been detected in this area. The highest TCE concentration observed between 1994 and 1996 was 26 μg/L in SIBW-3U in July 1994, and the concentrations have decreased to less than 5 μg/L in 1998. The downgradient extent of groundwater contaminated above MCLs in

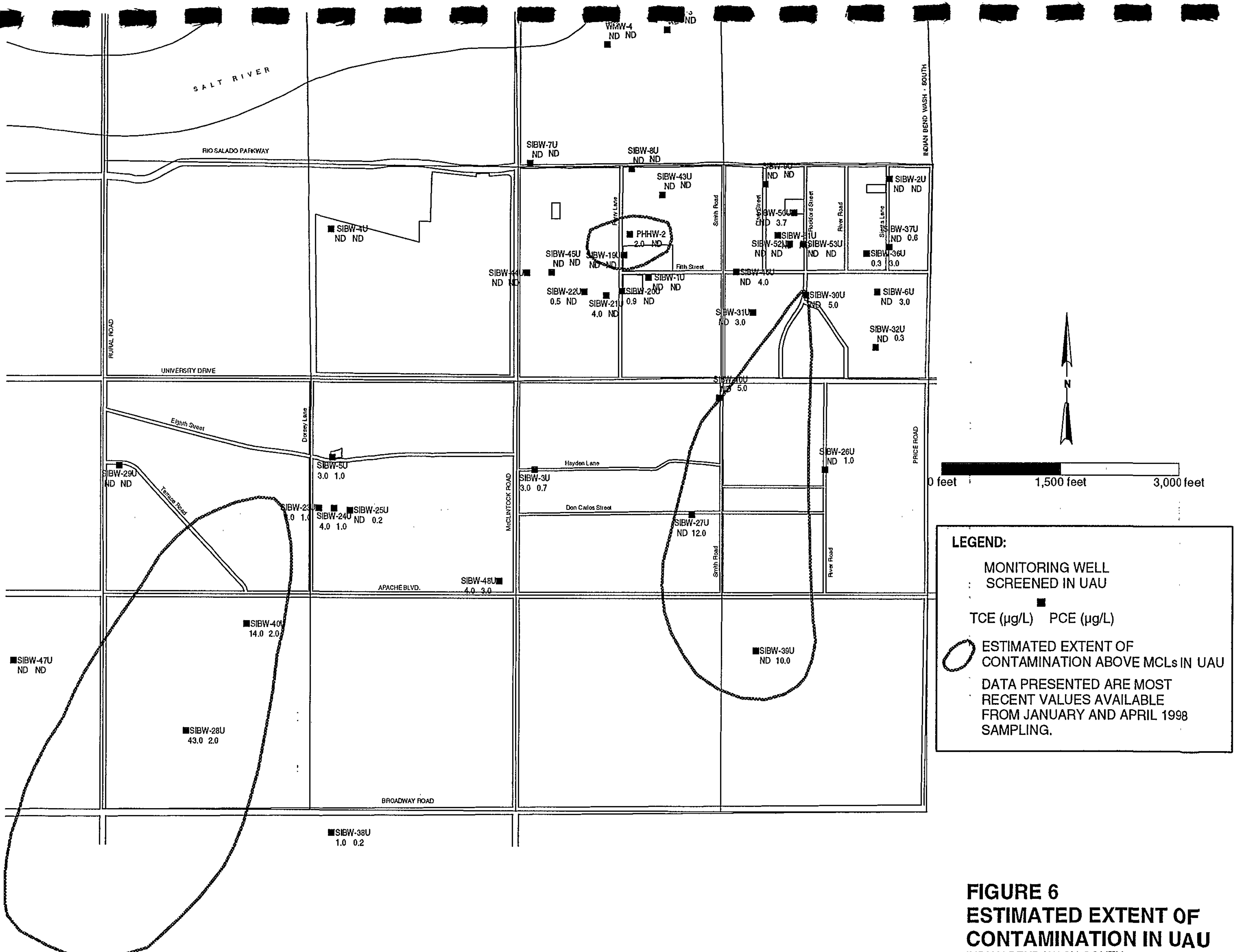


FIGURE 6
ESTIMATED EXTENT OF CONTAMINATION IN UAU
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

the central contaminated area appears to be near SIBW-48U. PCE is also detected in Wells SIBW-3U and SIBW-48U. The eastern and western extent of the central contaminated area is not well defined. Methyl tertiary butyl ether (MTBE) recently has been detected at levels significantly above Arizona's Health Based Guidance Level (HBGL) of 35 µg/L and EPA's health advisory range of 20 to 40 µg/L for taste and odor. The higher levels of MTBE are located near the central contaminated area, where ADEQ has issued a corrective action plan under its Leaking Underground Storage Tank (UST) program. If it becomes apparent that ADEQ's UST efforts will not result in the cleanup of MTBE in the aquifer, EPA will evaluate the necessity and appropriateness of remedial action for MTBE.

- *Eastern area of contamination.* A third, relatively broad area of PCE-contaminated groundwater is found in the eastern portion of the study area. This area is partially defined, from northeast to southwest, by Wells SIBW-50U, SIBW-36U, SIBW-46U, SIBW-6U, SIBW-31U, SIBW-10U, SIBW-26U, SIBW-27U, and SIBW-39U. PCE concentrations of 59 µg/L were observed in SIBW-51U in February 1994, and may indicate the well is located near a source of contamination. The downgradient extent of this contamination is undefined. Since 1994, the PCE concentrations have decreased in SIBW-51U to less than 5 µg/L, and have remained relatively constant in most of the other UAU wells in this area. PCE concentrations have equaled or exceeded 10 µg/L in SIBW-39, the farthest downgradient well in this contaminated area from April 1995 to April 1998. As with the western and central contaminated areas, the eastern and western extent of this contaminated area is not well defined.

Middle Alluvial Unit

Two areas of VOC contamination are found in the MAU, one in MAU Subunit B, the other in MAU Subunit C. The MAU subunits primarily are found in, and thus also have been sampled in, the eastern and central areas of IBW-South. PCE was not detected during the April 1998 sampling event in groundwater samples collected from the MAU or LAU. The current interpretation of the extent of the VOC contamination in the MAU, as shown on Figure 7, and LAU is summarized below:

- *Subunit B.* Groundwater contaminated with TCE is found in MAU Subunit B in the vicinity of SIBW-16MB in the south-central portion of the study area. Measured TCE concentrations range from 9 to 4 µg/L. The horizontal extent of this contamination is undefined.

- *Subunit C.* Groundwater contaminated with TCE occurs in MAU Subunit C in the eastern portion of the study area. This low concentration area (up to 12 µg/L) is defined by Wells SIBW-11MC, SIBW-13MC, SIBW-56MC, SIBW-57MC, and SIBW-58MC. The eastern and southern limits of this area of contamination are undefined. The TCE concentrations have not fluctuated significantly in this contaminated area since 1992.

  MAU Subunit C is believed to pinch out directly west of the currently defined TCE area of contamination (approximately 500 to 1,000 feet west of COT No. 7). This suggests that the observed MAU Subunit C contamination may be related to the observed contamination upgradient in MAU Subunit B.

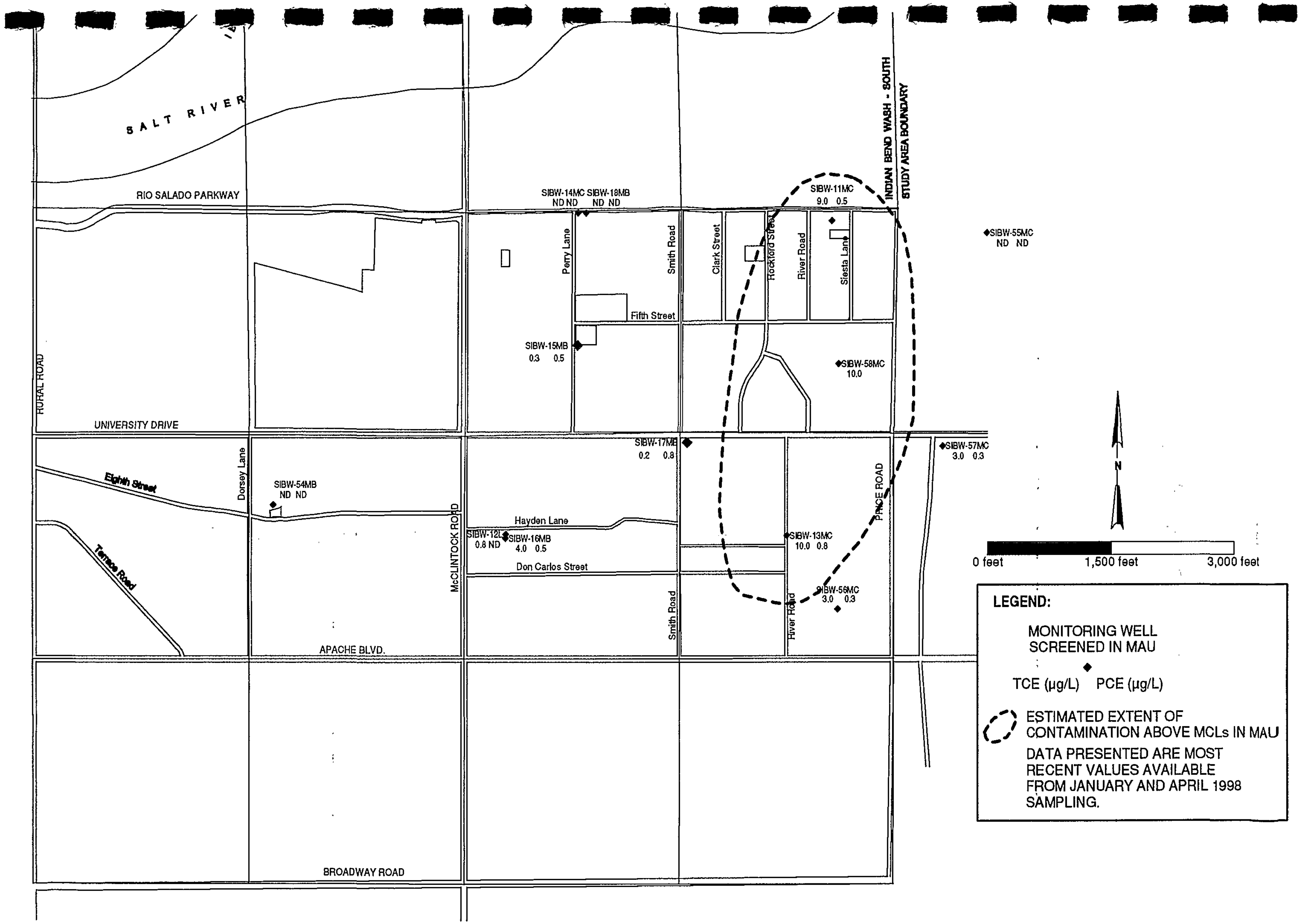


FIGURE 7
ESTIMATED EXTENT OF CONTAMINATION IN MAU
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

ODIN:147921:ROD SUPPORT:FIGURES:SURFER:ROD-07.SRF

- PCE has not been detected above MCLs in the MAU or LAU since 1985.

Lower Alluvial Unit

Low concentrations of contamination have been detected in the LAU. A 1984 sample from the Kachina well, in the north-central portion of the IBW-South study area, contained PCE at 5 µg/L. Since that sampling event, all samples collected from this well have been below 2 µg/L for PCE. Another well, SRP Well 23E,2.9N, had detected concentrations of TCE, but it is screened across the UAU, MAU and LAU, and is therefore not useful in determining the extent of contamination in the LAU. EPA installed one LAU well, SIBW-12L, in early 1991 in the south-central portion of the IBW-South study area, as part of the RI. Concentrations of PCE and TCE in samples collected from SIBW-12L to date have not exceeded 1 µg/L.

6.2 Migration Pathways

This section describes surface and subsurface migration pathways for the VOCs in ground-water. Figure 8 is a conceptual diagram of the migration pathways for VOCs at IBW-South.

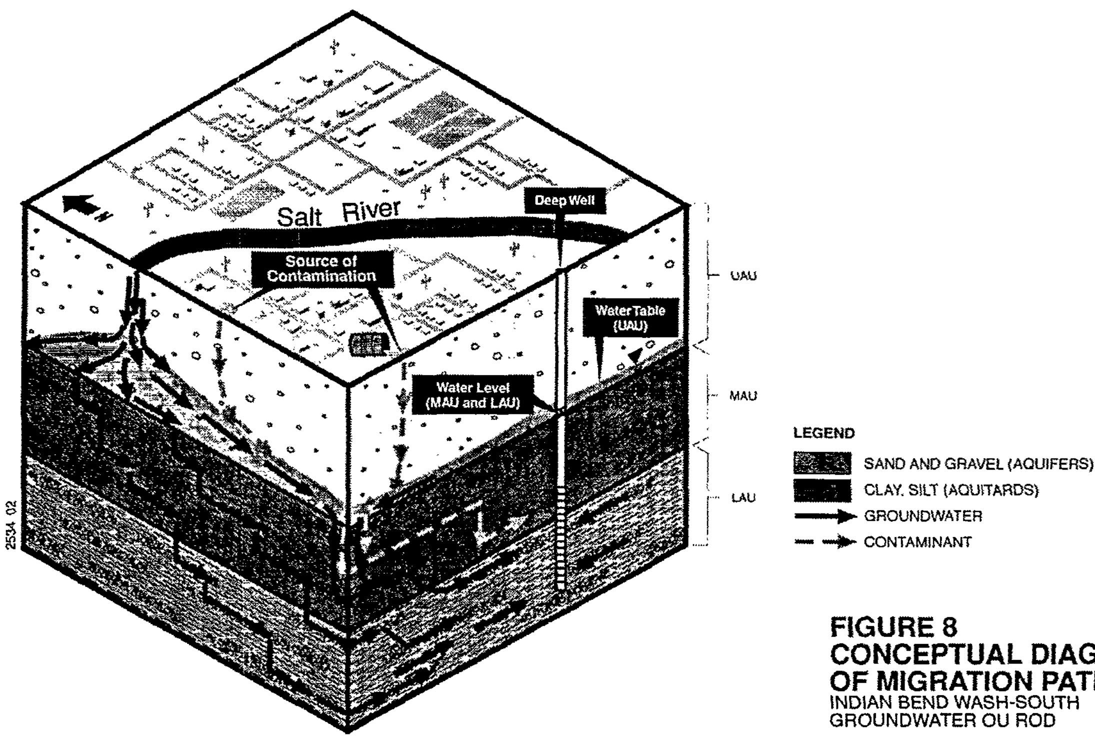


FIGURE 8
CONCEPTUAL DIAGRAM OF MIGRATION PATHWAYS
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

Migration pathways considered the following for VOCs in groundwater at IBW-South:

- Contaminant movement from source areas
- Chemical and biological processes that may degrade contaminants as they move through the IBW-South hydrogeologic system

- Mechanisms that affect contaminant movement through the vadose zone
- Mechanisms that affect movement through the saturated water-bearing zones

Contaminant Movement from Source Areas

A wide variety of manufacturing industries currently operates, or has operated in the past, at IBW-South. Printed electronic circuit-board manufacturing, metal plating, commercial laundry cleaning, engine repair and manufacturing, vehicle repair, jewelry manufacturing, plastics manufacturing, and mortar and grout manufacturing represent some of the industrial activities that have occurred in the past. Landfills currently operate or have operated in the past at IBW-South. Some of these industries used hazardous substances in their manufacturing process that could, if discharged into the ground in sufficient quantity, pose a threat to human health and the environment. Hazardous substances most commonly used by industries at IBW-South include degreasing and dry cleaning solvents, metal plating solutions, acid and base solutions, and fuel oils. When the hazardous substances used by a facility are released into the ground, the facility becomes a source of contamination.

Possible mechanisms for release of hazardous substances into the subsurface at IBW-South are:

- Spills or leakage from drums or other hazardous substances containers
- Disposal of used or unneeded hazardous substances into dry wells, septic systems, or directly onto the ground surface
- Infiltration from industrial wastewater surface impoundments
- Leakage from underground storage tanks

Contaminant Movement in the Vadose Zone

One mechanism that affects contaminant movement in the vadose zone at IBW-South is infiltration from source areas. Contaminants discharged from source areas migrate vertically downward under gravitational forces and may also disperse horizontally as a result of capillary action. Infiltration of precipitation at IBW-South serves to dissolve and/or displace the contaminants and transport them downward toward the groundwater table.

The water table elevation at IBW-South exhibits significant temporal variation (elevation changes of up to 40 feet were observed during 1993). When the water table drops, some of the groundwater contamination may be left behind in the vadose zone, creating a "smear zone" of residual contamination in the vadose zone. Similarly, when the water table rises, some of the contamination adsorbed to sediments near the groundwater table may dissolve into the groundwater.

When contaminants move through the vadose zone, they will partition between mobile phases and relatively immobile phases when the contaminants are either sorbed by organic material or soil minerals. The mobility of contaminants through the vadose zone depends on both the contaminant and the vadose zone chemical and physical properties.

Contaminant Movement in the Upper Alluvial Unit

Groundwater and VOC contaminant movement varies throughout the site and with depth. The following is a brief discussion of the predominant paths of contaminant movement within the shallowest water-bearing unit, the UAU. The UAU mainly comprises permeable, coarse-grained sands and gravel. Contaminants enter the UAU by moving downward through the vadose zone, dissolving, and moving with the groundwater flow. Contaminants can also enter the UAU when the water table rises into contamination in the vadose zone. The contaminants then become soluble and move with prevailing groundwater flow.

Important characteristics of groundwater movement in the UAU at IBW-South are the strong downward vertical hydraulic gradients, changes in groundwater flow directions, and high horizontal hydraulic gradients caused by flow events in the Salt River. The changes in groundwater recharge patterns caused by intermittent flow in the Salt River have significant implications for contaminant transport at IBW-South. The groundwater flow direction in the UAU shifts from south-southwest to south-southeast, and these shifts in flow direction may spread out areas of contamination. Also, the increased horizontal gradient may cause contaminants to move large distances over short time periods.

Future groundwater conditions are expected to be similar to those observed in recent history, e.g., the flow directions and rate of groundwater movement will vary within similar ranges, and will be most affected by the frequency and durations of flow events in the Salt River. The construction of Town Lake is not expected to significantly affect regional groundwater flow patterns. Extraction wells surrounding the upstream (eastern) boundary of the lake will be operated to recirculate water that recharges through the lake bottom. These wells are expected to prevent significant amounts of recharge from impacting the volume of water that flows through the contaminated portions of groundwater at the site.

The groundwater table fluctuates more than 50 feet at the site. These fluctuations in groundwater levels can either leave residual areas of contamination when the water table falls, or cause vadose zone contaminants to become dissolved in the groundwater when the groundwater table rises.

Contaminant Movement in the Middle Alluvial Unit

The MAU is finer-grained than the UAU. Contaminants are introduced into the MAU by downward-migrating groundwater from the UAU moving through relatively finer-grained sediments to the coarser-grained water-producing zones within the MAU. Significant amounts of contamination can also move to the MAU by groundwater flowing or cascading down wells that are screened across both the UAU and MAU. The downward gradients observed at IBW-South can cause contaminant-laden groundwater entering the well in the UAU to move downward and exit the well in the MAU.

The MAU groundwater flow directions and gradients differ from those in the UAU. Current data suggest that the northeast MAU flow direction may be completely opposite to UAU groundwater flow because of naturally and artificially induced regional flow patterns. Vertical hydraulic gradients present in the MAU also tend to move the contaminants downward within the MAU.

Contaminant Transformation and Biodegradation

VOC contaminants will be subject to transformation and degradation via chemical and biological processes. Chlorinated solvents, which are the most commonly detected contaminants in the IBW-South groundwater system, may degrade to produce a variety of products such as alkanes, alcohols, acetates, aldehydes, carbon dioxide, and chloride ions. The VOC contaminants also degrade into other chlorinated solvent species. The measured presence of 1,1-DCA and 1,2-DCE in some groundwater samples collected from IBW-South provides evidence that biodegradation is occurring in limited areas. Biodegradation may be taking place under localized anaerobic conditions. However, estimated rates of biodegradation are not fast enough to prevent contaminated groundwater from migrating.

Natural Attenuation Processes

It appears that dispersion, dilution, and related natural attenuation processes that reduce VOC contaminants are occurring at IBW-South. Contaminant movement patterns and decreasing levels of contaminants in groundwater at source areas indicate the effectiveness of natural attenuation processes at IBW-South. Modeling based on these data trends further supports these observations and is discussed in Section 8.0 of this ROD.

7.0 Site Risks

This section presents a summary of the baseline human health risk assessment presented in Appendix A and Chapter 4.0 of EPA's *Final Groundwater Feasibility Study Report*, dated August 1997. The baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. It serves as the baseline indicating what risks could exist if no action were taken at the site.

7.1 Summary of Site Risks

According to the results of the Baseline Risk Assessment presented as Appendix A in the Groundwater FS (EPA, 1997), exposure to contaminated groundwater might in the future pose levels of risk considered unacceptable under the NCP. The potential exposure pathway includes future use of untreated groundwater at IBW-South for drinking or showering. It must be noted that no exposure pathways currently exist because the groundwater at IBW-South does not serve as a source of water supply at this time. An exception is COT No. 7, which has been used as an emergency backup water supply only once since 1990.

Although the contaminated groundwater at IBW-South is not currently used for drinking water, it is classified as a drinking water source by the State of Arizona. Both the state and the City of Tempe have expressed the desire that the groundwater be restored to this beneficial use, which is consistent with the expectation in the NCP.

Ecological Risk Assessment

An ecological risk assessment evaluates risks posed to ecological receptors. An ecological risk assessment need not be performed for the Groundwater OU at IBW-South because groundwater does not discharge to surface water. No upwelling is known to occur in the vicinity of the Salt River, and vertical gradients are downward. Because no current or future pathways of exposure to VOC-contaminated groundwater exist for ecological receptors at IBW-South, an ecological risk assessment was not performed.

Summary of Human Health Risk Assessment

This section briefly summarizes the results of the human health risk assessment. The baseline risk assessment estimates what risks the site poses if no action is taken. It provides a basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site, which were presented in Appendix A of the Groundwater Feasibility Study (EPA, 1997). This summary of the human health risk assessment includes the following elements:

- Identification of the chemicals of concern (COCs)
- Exposure assessment
- Toxicity assessment
- Risk characterization

Identification of Chemicals of Concern

COCs (i.e., the chemicals that are the most toxic, mobile, persistent, or prevalent of those detected at the site) are selected from among the entire set of chemicals associated with groundwater at IBW-South. The purpose for identifying and selecting the COCs is to focus the risk assessment on the most important chemicals (i.e., those chemicals presenting 99 percent of the total risk) detected at the site.

Monitoring well samples from IBW-South were analyzed for 56 different VOC parameters. Thirty-five of the VOC parameters were detected at least once in the groundwater samples analyzed and 21 of the VOCs were never detected. PCE and TCE were detected most frequently. VOCs other than PCE and TCE were detected; however, they were detected at considerably lower frequencies.

PCE and TCE in groundwater are the COCs at IBW-South. These chlorinated solvents constitute the largest portion of the risk in both the UAU and the MAU/LAU. TCE and PCE were detected in approximately 40 percent of the samples collected between January 1994 and February 1996, and also have been consistently detected in the same monitoring wells over many sampling periods. Because TCE and PCE are frequently detected, the potential for exposure to these contaminants is also higher.

Exposure Assessment

Exposure refers to the potential contact of an individual with a chemical. Human exposure to chemicals is typically evaluated by estimating the amount of chemicals which could come into contact with the lungs, gastrointestinal tract, or skin during a specified period of time. The potential pathways of exposure; frequency and duration of potential exposures; rates of contact with air and water; and the concentrations of chemicals in groundwater are evaluated in the assessment of human intake of COCs.

Groundwater supply wells exist at the IBW-South Site. These wells are owned by the City of Tempe, and contamination discovered in these wells in 1981 (see Site History) is a reason that IBW is listed as a Superfund Site. These wells are not currently used for domestic supply, although COT No. 7 was used as an emergency backup water supply once since the wells were placed out of service in 1989.

The risk assessment therefore evaluated potential future exposures to untreated groundwater for the following domestic uses:

- *Direct ingestion* as a drinking water source (i.e., drinking and cooking)
- *Inhalation and dermal absorption* of contaminants during bathing and showering and VOCs released to the air during cooking or the use of household appliances such as washing machines.

Ingestion. The magnitude of exposure to contaminants through ingestion depends on the amount of water ingested on a daily basis. This assessment assumed that adult residents consume 2 liters of water per day, 350 days per year for approximately 30 years. The 2-liters-per-day value is close to the 90th percentile for drinking water ingestion (EPA, 1990b). The 30-year exposure duration is considered to be a 90th percentile value for time spent at one residence. The other parameters used in this intake equation also represent reasonable maximum values.

The parameters used for estimating chemical intake from ingestion of contaminants in groundwater are shown in Table 3.

TABLE 3
Parameters for Estimating Chemical Intake From Ingestion of Contaminants in Groundwater

Parameter	Description	Units	Value
Intake	Chemical intake rate	mg/kg-day	Calculated
Cw	Chemical concentration in water	mg/L	modeled or measured value
BW	Body weight	kg	70
AT	Averaging time	years	70 (cancer effects) 30 (noncancer effects)
EF	Exposure frequency	days/years	350
ED	Exposure duration	years	30
Irw	Daily water ingestion rate	L/day	2

A lifetime average intake of a chemical is estimated for carcinogens. This acts to prorate the total cumulative intake over a lifetime. An averaging time of a 70-year lifetime is used for carcinogens. Chemical intake rates for noncarcinogens are calculated using an averaging time that is equal to the exposure duration.

Inhalation. Exposure to VOCs in air in a residential exposure scenario was estimated from an inhalation rate of 15 cubic meters per day (m^3/day). This inhalation rate considers the potential for exposure during household water uses, such as cooking, laundry, bathing, and showering. Activity-specific inhalation rates were combined with time/activity level data for populations that spend a majority of their time at home to derive daily inhalation values. The inhalation rate of 15 m^3/day was found to represent a reasonable upper-bound value for daily, indoor residential activities (EPA, 1991a).

The parameters used for estimating intake from inhalation of VOCs are shown in Table 4.

TABLE 4
Inhalation Parameters

Parameter	Description	Units	Value
Intake	Chemical intake rate	mg/kg-day	calculated
C_a	Chemical concentration in air	mg/m^3	modeled value
BW	Body weight	kg	70
AT	Averaging time	years	70 (cancer effects) 30 (noncancer effects
EF	Exposure frequency	days/year	350
ED	Exposure duration	years	30
Ir_a	Daily inhalation rate	m^3/day	15

Dermal Absorption. Individuals can become exposed through dermal absorption of contaminants in water. The magnitude of potential exposure through this pathway is related to the concentration in water and surface area of exposed skin, the ability of the contaminant to penetrate through the skin, and frequency and duration of exposure.

The parameters used for estimating intake of VOCs from dermal contact with groundwater are shown in Table 5.

TABLE 5
Parameters for Estimating Chemical Absorption from Dermal Contact with Groundwater

Parameter	Description	Units	Value
Absorbed dose	Chemical intake rate	mg/kg-day	Calculated value
Cw	Concentration in water	mg/L	Modeled or measured value
SA	Exposed skin surface area	cm^2/event	23,000
ET	Exposure time	hours/day	0.25
EF	Exposure frequency	event/year	350
ED	Exposure duration	years	30
BW	Body weight	kg	70
AT	Averaging time	years	70 (cancer effects) 30 (noncancer effects)
Kp	Dermal permeability coefficient	cm/hour	Chemical-specific

Toxicity Assessment

The toxicity assessment determines the relationship between the magnitude of exposure to a chemical and the adverse health effects. This assessment provided, where possible, a numerical estimate of the increased likelihood and/or severity of adverse effects associated with chemical exposure. These toxicity values represent the potential magnitude of adverse health effects associated with exposure to chemicals, and are developed by EPA. These values represent allowable levels of exposure based upon the results of toxicity studies or epidemiological studies. The toxicity values are then combined with the exposure estimates (as presented in the previous sections) to develop the numerical estimates of carcinogenic risk and noncarcinogenic health risks. These numerical estimates are then used in the risk characterization process to estimate adverse effects from chemicals potentially originating in groundwater.

Toxicity values (cancer slope factors and reference doses) used in the risk assessment were obtained from these sources:

- The Integrated Risk Information System (IRIS), EPA, 1996, a database available through EPA National Center for Environmental Assessment in Cincinnati, Ohio. IRIS, prepared and maintained by EPA, is an electronic database containing health risk and EPA regulatory information on specific chemicals.

- The Health Effects Assessment Summary Tables (HEAST), provided by EPA's Office of Solid Waste and Emergency Response (OSWER) (EPA, 1995). HEAST is a compilation of toxicity values published in health effects documents issued by EPA. HEAST is for use in Superfund and RCRA programs.

Toxicity information for the COCs at IBW-south is summarized in Table 6.

TABLE 6
Toxicity Information for COCs at IBW-South

Chemical of Concern	Slope Factor Ingestion 1/(mg/kg-d)	Reference Dose, Ingestion (mg/kg-d)	Slope factor Inhalation 1/(mg/kg-d)	Reference Dose Inhalation (mg/kg-d)	Weight of Evidence Classification System for Carcinogenicity
Tetrachloroethene (PCE)	5.1E-02	1.0E-02	2.0E-03	1.0E-02	(Category B2) Probable human carcinogen, based on sufficient evidence in animals and inadequate or no evidence in humans
Trichloroethene (TCE)	1.1E-02	6.0E-03	6.0E-03	6.0E-03	(Category B2) Probable human carcinogen, based on sufficient evidence in animals and inadequate or no evidence in humans

Risk Characterization

Increased lifetime cancer risk (ILCR) estimates and noncancer hazard indexes (HIs) were calculated for all compounds detected in samples collected between January 1994 and February 1996. The data collected between these dates provide the best evaluation of the spatial extent of groundwater contamination. Total ILCR and noncancer HIs were calculated by summing the risk from the ingestion, inhalation, and dermal contact pathways associated with each compound in each sample collected between January 1994 and February 1996.

A summary of the most frequently detected compounds in the UAU and the MAU/LAU is presented in Table 7. This table contains the minimum and maximum concentration detected; the minimum, maximum, and mean total ILCR; and the minimum, maximum, and mean HI for each compound detected.

PCE and TCE were detected most frequently in the UAU and the MAU/LAU wells. The highest ILCR associated with PCE and TCE in the UAU was 5×10^{-5} and 4×10^{-5}, respectively. The highest ILCR associated with PCE and TCE in the MAU/LAU was 8×10^{-7} and 5×10^{-6}, respectively. 1,2-Dibromoethane (ILCR=3×10^{-3}) and benzene (ILCR=2×10^{-4}) have the highest ILCRs. An HI greater than one is also associated with 1,2-dibromoethane (HI=5) and benzene (HI=8).

TABLE 7
Sitewide Risks for VOCs Detected between January 1994 and February 1996 at IBW-South

Parameter	No. of Detects	No. of Samples	Concentration (mg/L)		Risk			Hazard Index		
			Min	Max	Min	Max	Mean	Min	Max	Mean
Upper Alluvial Unit										
1,2-Dibromoethane	8	205	0.0002	0.003	2.1E-04	3.1E-03	1.3E-03	3.6E-01	5.4E+00	2.2E-00
Benzene	12	355	0.002	0.14	3.3E-07	2.3E-04	8.7E-05	1.2E-02	8.4E+00	3.2E+00
Trichloroethene (TCE)	139	354	0.0001	0.09	4.1E-08	3.6E-05	5.7E-06	2.2E-03	2.0E+00	3.1E-01
Tetrachloroethene (PCE)	194	355	0.00006	0.059	4.6E-08	4.6E-05	4.1E-06	8.0E-04	6.5E-01	7.9E-02
Lower and Middle Alluvial Unit										
1,2-Dibromoethane	5	92	0.0006	0.002	6.3E-04	2.1E-03	1.3E-03	1.1E+00	3.6E+00	2.4E+00
Bromodichloromethane	2	243	0.0008	0.002	2.8E-06	6.9E-06	4.9E-06	5.2E-03	1.3E-02	9.1E-03
Trichloroethene	116	258	0.0002	0.0174	8.1E-06	5.3E-06	2.2E-06	4.4E-03	2.9E-01	1.2E-01
1,2-Dichloroethane	4	243	0.0002	0.0014	1.0E-06	2.0E-06	1.4E-06	7.2E-03	1.4E-02	9.6E-03
Tetrachloroethene	96	253	0.0001	0.006	7.7E-08	7.7E-07	3.8E-07	1.3E-03	1.3E-02	6.5E-03
Chloromethane	1	241	0.0008	0.0008	3.5E-07	3.5E-07	3.5E3-05	2.9E-02	2.9E-02	2.9E-02
Benzene	1	238	0.0002	0.0002	3.3E-07	3.3E-07	3.3E-07	1.2E-02	1.2E-02	1.2E-02
Methylene Chloride	9	247	0.0002	0.001	3.3E-08	5.9E-08	5.9E-08	1.2E-04	4.1E-04	2.1E-04

Under the NCP, remediation goals are based on ARARs or other reliable information (NCP, 40 CFR Section 300.430(e)(2)). For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6} using information on the relationship between dose and response. The 1×10^{-6} risk level is a point of departure for determining remediation goals when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple exposure pathways. An HI (the ratio of chemical intake to the reference dose) greater than one indicates that some potential exists for adverse noncancer health effects associated with exposure to the contaminants of concern.

If residents were exposed to TCE and PCE in the groundwater through drinking water or routine household uses, the potential for increased cancer risks and noncancer health effects exists. Action is warranted under EPA's risk assessment for that reason and because contamination exceeds MCLs, which are standards adopted for the protection of human health and which are, under the NCP, standards relevant and appropriate for the restoration of drinking water, and because it is expected that the aquifer will be restored to meet drinking water standards.

8.0 Description of Remedial Alternatives

An FS was prepared in August 1997 to evaluate remedial alternatives for VOCs in groundwater at IBW-South. The remedial alternatives were developed to meet the Remedial Action Objectives (RAOs). RAOs are narrative statements that define the extent to which sites require cleanup to meet the underlying objectives of protecting human health and the environment. RAOs reflect COCs, exposure routes and receptors, and acceptable contaminant levels (or a range of acceptable contaminant levels) for each medium. RAOs can be divided into general RAOs that can be applied to all CERCLA sites, and specific RAOs that reflect site-specific conditions at IBW-South.

Remedial Action Objectives

The general RAOs for remedial actions at IBW-South include the following:

- Maintain protection of human health and the environment by reducing the risk of potential exposure to contaminants
- Expedite site cleanup and restoration
- Use permanent solutions to the maximum extent practicable
- Restore contaminated groundwater to the extent practicable to support existing and future uses
- Achieve compliance with applicable or relevant and appropriate requirements (ARARs)
- Minimize untreated waste

The specific RAOs for the groundwater below IBW-South include the following:

- Protect human health by minimizing the potential for human exposure to groundwater exceeding cleanup goals
- Cost-effectively reduce contamination in groundwater to concentrations that meet cleanup goals to return groundwaters to their beneficial uses to the extent practicable within a time frame that is reasonable, given the particular circumstances of the site
- Protect groundwater resources by preventing or reducing migration of groundwater contamination above ARARs.

Action is warranted because groundwater contamination exceeds MCLs, which are associated with unacceptable risk to human health and the environment, and it is expected that the aquifer will be restored to meet these drinking water standards. Thus, remedial actions should minimize the potential for future human exposure to contaminated groundwater.

Given these RAOs, several alternatives were assembled from the applicable remedial technology process options and were screened for their effectiveness, implementability, and cost. The alternatives passing this screening were then evaluated in further detail against the nine criteria required by the NCP. This section provides a description of each alternative that was retained for the detailed screening analyses in the FS. These alternatives consider No Action, as required by the NCP, to provide a point of comparison for other alternatives.

The six alternatives that were retained for detailed analysis in the FS are:

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation
- Alternative 3: Limited Action: Wellhead Treatment at COT No. 7/ COT Potable Water
- Alternative 4: Partial Containment: Extraction Wells/Treatment Plant Air Stripping/Discharge to Town Lake via City of Tempe Storm Drain/Monitored Natural Attenuation
- Alternative 5: Regional Containment: Extraction Wells/Treatment Plant Air Stripping/Discharge to SRP Tempe Canal No. 6
- Alternative 6: Regional Containment: Extraction Wells/Treatment Plant Air Stripping/Aquifer Reinjection

In the Proposed Plan, EPA selected Alternative 4 as the preferred remedy. After reviewing public comments on the Proposed Plan, and after additional data were collected and evaluated, that alternative was modified from that described in the Proposed Plan, although the general components of the preferred remedy remained the same. Section 10.0 provides an explanation of the significant differences between the preferred alternative in the proposed plan and the selected remedy. The components of the selected remedy and the contingency remedy are described in this section, along with the alternatives listed above that were evaluated in the FS and the Proposed Plan. Additional information and analysis of the selected remedy and contingency remedy are provided in Sections 9.0, 10.0, and 11.0.

A description of the cost estimating procedures is provided below, followed by additional information for each alternative.

Cost Estimating Procedures

The alternatives were evaluated in terms of capital costs, annual operation and maintenance (O&M) costs, and present worth costs. Capital costs include the sum of the direct capital costs (materials, equipment, labor, land purchases) and indirect capital costs (engineering, licenses, or permits). Annual costs include the cost for labor, O&M, materials, energy, equipment replacement, disposal, and sampling to operate the treatment facilities. Present worth costs include capital costs and O&M costs calculated over an approximate 30-year period.

The accuracy of costs is subject to substantial variation because the specific design of each alternative (e.g., design details, the bidding climate, changes during construction and operation, interest rates, labor and equipment rates, tax effects, and other similar items) will not be known until the time of actual implementation of the remedy.

Remedial Design efforts may reveal that it is possible to reduce the original project cost estimates. Design assumptions presented here may change. This is acceptable because details of the remedial alternatives presented here are conceptual in nature and subject to refinement during remedial design. Reductions in the estimated costs could be the result of value engineering conducted during Remedial Design (RD). Through the value engineering process, modifications could be made to the functional specifications of the remedy to optimize performance and minimize costs. These changes would fall within the definition of "non-significant modifications," as defined by EPA's guidance for preparing Superfund decision documents. For example, it may be determined that a reduction in costs could be affected by non-significant changes to type, quantity, and/or cost of materials, equipment, facilities, services, and supplies used to implement the remedy. It should be noted that this type of design variance may have a noticeable impact on the estimated cost of the remedy, but will not affect the remedy's ability to comply with the performance standards.

The present worth analysis is used to evaluate expenditures that would occur over an assumed 30-year operation period by discounting all future costs to a common base year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as scheduled, would be sufficient to cover the costs associated with the remedial alternative over its planned life.

Features Common to All Remedial Alternatives

The five remedial alternatives (other than the No-Action Alternative) evaluated in the FS, and the selected remedy and contingency remedy have common features. The cost estimates for each alternative include costs for each of these features. The common features are listed below:

- **Institutional Controls**–Institutional controls are put in place to protect the public from exposure to contaminated groundwater exceeding aquifer cleanup levels until cleanup goals are met. Institutional controls will include various Arizona well siting, permitting, and construction restrictions, and notices distributed by the Arizona Department of Water Resources, Arizona Department of Health Services, or EPA concerning risks from exposure to contaminated groundwater. Additional institutional controls to prevent interference with EPA's remedial efforts also may be established.

- **Compliance Monitoring**–To ensure that the performance standards are met for groundwater, a long-term monitoring program was included in each alternative and the selected remedy and contingency remedy. The monitoring program will be designed and implemented during Remedial Design/Remedial Action (RD/RA) and will continue throughout the implementation of the selected groundwater remedy. The monitoring program will assess compliance with the remediation levels in the groundwater system, monitor effluent chemical concentrations after VOC treatment, and evaluate the horizontal and vertical migration of contamination. Details of the monitoring program will be determined by EPA during the RD. The monitoring program will include, at a minimum, the following: analytical parameters and methods; indicator parameters; monitoring locations; monitoring frequency and duration; sampling methods; well installation, and maintenance and abandonment procedures; reporting methods and procedures for tracking and maintaining sample records; and quality assurance (QA) methods.

- **Well Sealing or Abandonment**–Well SRP23E,2.9N will be sealed to eliminate this potential path of VOC contamination from the UAU to the MAU. In addition, other monitoring wells that are not required for compliance or natural attenuation monitoring will be properly abandoned as appropriate.

Another common feature to all alternatives is the Five-Year Review. The cost of this review was not included in the alternatives. Five-year reviews will be conducted as a matter of policy, because it will take more than 5 years to achieve aquifer cleanup levels to allow for unlimited use and unrestricted exposure. EPA will conduct a 5-year review within 5 years of construction completion to ensure protection of human health and the environment. This review will evaluate the effectiveness of the remedy and institutional controls. An additional purpose for the review is to evaluate whether the performance standards specified in this ROD remain protective of human health and the environment. EPA will continue the reviews until no hazardous substances, pollutants, or contaminants remain at IBW-South above aquifer cleanup standards.

Groundwater Treatment Component

A common feature to Alternatives 4, 5, and 6 is the use of a representative treatment process option for the ex-situ treatment component of the groundwater remedy. Air stripping with vapor-phase granular activated carbon (VGAC) for offgas treatment was selected as the representative treatment process option, as described in Section 6.2.3 and Appendix C of the Groundwater FS (EPA, 1997.) A representative process option was selected to simplify the subsequent development and evaluation of alternatives and the cost estimate. The treatment component of the remedy will use presumptive technologies identified in OSWER Directive 9283.1-12. One or a combination of those technologies will be used for VOCs in extracted groundwater. The specific treatment process will be finalized during the remedial design phase, based on information to be gathered at that time..

The following treatment processes passed the screening of treatment options using the criteria of effectiveness, implementability, and cost: liquid-phase granular activated carbon (LGAC), air stripping with VGAC, and Ultraviolet Light Oxidation (UV/Ox). Each of these treatment processes could be used for groundwater remediation at IBW-South. A brief description of each treatment is provided below:

- LGAC—This process option uses direct contact of the contaminated water with activated-carbon to promote adsorption of contaminants onto the carbon.
- Air Stripping/VGAC Offgas Treatment—This process option combination uses air-water contacting towers to promote transfer of contaminants from the water into an airstream. The airstream is then passed through an activated carbon bed where the contaminants adsorb onto the carbon.
- UV/Ox—This process option uses a chemical reagent and UV light to oxidize the contaminants. The reagent used is an aqueous solution of hydrogen peroxide or ozone.

Each of these technologies, if selected, would be designed to attain chemical-specific discharge requirements and to maximize long-term effectiveness and reliability while minimizing long-term operating costs.

Table 8 describes the components, cost, and estimated restoration time frame for the alternatives evaluated in the FS. The selected remedy and contingency remedy are also described. The area that will be hydraulically contained is listed in addition to the treatment technology and discharge location. Table 8 provides the number of new monitoring and extraction wells included in each alternative, and the total annual extraction rate. The capital cost, annual O&M cost, and 30-year present worth costs are provided. The estimated total lengths of conveyance

TABLE 8
Components of Selected Remedy, Contingency Remedy, and Alternatives Evaluated in Feasibility Study

Component	Alternative 1[a]	Alternative 2	Alternative 3	Alternative 4 (Selected Remedy)	Contingency Remedy[b]	Alternative 5	Alternative 6
Estimated Restoration Time Frame (years)[c]	>50	>50	>50	<30	<30	<30	<30
Containment[d]	None	None	None	Partial	Partial	Complete	Complete
Treatment[e]	None	None	Wellhead air stripping at COT No. 7 with offgas treatment by VGAC	Air stripping with offgas treatment by VGAC	Air stripping with offgas treatment by VGAC (1 additional tower)	Air stripping with offgas treatment by VGAC	Air stripping with offgas treatment by VGAC
Discharge End Use[f]	None	None	City of Tempe Potable Water Distribution System by pipeline	To be determined[c]	To be determined[c]	SRP Tempe Canal No. 6 by pipeline	Aquifer reinjection to MAU
Number of New Monitoring and Extraction Wells[g]	0	Five monitoring wells		Three UAU extraction wells, 10 UAU monitoring wells	To be determined during Remedial Design for the contingency	Twelve extraction wells, five monitoring wells	Twelve extraction wells, eight monitoring wells
Total Extraction Rate (ac-ft/yr)	0	0	Negligible	4,740	2,420	14,070	15,680
Capital Cost ($)	0	890,000	1,240,000	6,170,000	2,410,000	12,600,000	21,260,000
Annual O&M cost ($)	0	100,000	440,000	1,060,000	10,000	1,540,000	1,800,000
30-year Present Worth Cost ($)	0	2,580,000	8,000,000	22,460,000	2,570,000	36,270,000	48,930,000
Conveyance Pipeline Length from Extraction Wells to Treatment Plant (linear feet)	None	None	None	10,900	11,300	20,240	31,240
Distribution Pipeline Length from Treatment Plant to Discharge Location (linear feet)	None	None	None	50	0	3,600	27,000

[a] Alternative 1: No action.
Alternative 2: Monitored Natural Attenuation
Alternative 3: Limited Action: Wellhead Treatment at City of Tempe Well No. 7 /City of Tempe Potable Water
Alternative 4: Partial Containment: Extraction Wells/Treatment Plant Air Stripping/ Discharge to Town Lake via City of Tempe Storm Drain/Monitored Natural Attenuation
Alternative 5: Regional Containment: Extraction Wells/Treatment Plant Air Stripping/ Discharge to SRP Tempe Canal No. 6
Alternative 6: Regional Containment: Extraction Wells/Treatment Plant Air Stripping/Aquifer Reinjection

[b] Only the components that need to be added to the selected remedy are listed, i.e., only the additional cost is shown, not the total cost of the selected and contingency remedies.

[c] As described in Table 9.

[d] Partial containment refers to a volume of groundwater contaminated above MCLs that is less than the total volume of contaminated groundwater at the site, and includes only contamination in the upper aquifer (UAU). Complete containment refers to the entire volume of contamination above MCLs both in the UAU and MAU.

[e] Another treatment option may be implemented as described in the Proposed Plan, either LGAC or UV/Ox.

[f] The final discharge end use will be determined during Remedial Design, and will be to one of the end uses evaluated in the FS and Proposed Plan, specifically Town Lake, SRP Tempe Canal No. 6, and/or aquifer reinjection to the MAU. For costing purposes, Town Lake was assumed to be the discharge location.

[g] The number of new monitoring and extraction wells is an estimate and may increase or decrease depending on site conditions during Remedial Design.

and distribution pipeline that must be constructed are also included in the table. The estimated restoration time frame is provided, which is the number of years estimated for groundwater concentrations to reach MCLs throughout the entire contaminated areas. These numbers were estimated using a groundwater flow and solute transport model documented in the Technical Memorandum re *Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models* (EPA, 1998), which is part of the Administrative Record.

Included in the description of each alternative below is a discussion of whether the RAOs would be met by the alternative. A component in the evaluation of overall protection of human health and the environment is the prediction of how far the contaminated areas will migrate. A groundwater flow model and a solute transport model were used to simulate migration of the contaminant plumes. The results were presented in Appendix E of the Groundwater FS (EPA, 1997c). The model simulations required an initial concentration for the contaminant being modeled. In the FS, these initial concentrations were specified using water quality data through July 1994.

An updated solute transport analysis was performed subsequent to the publication of the Proposed Plan. The update incorporated more recent water quality data collected as of October 1997. The results of the updated solute transport analysis were presented in a technical memorandum (EPA, 1998), and were used to answer the following two questions for each alternative:

- Will MCLs (in situ groundwater cleanup ARARs) be met within a reasonable time?
- Does the MCL target volume expand before remediation goals are met?

The answers to these two questions for each alternative are summarized in Table 9 and will be discussed in more detail below in each alternative description.

8.1 Description of No-Action Alternative

Evaluation of the No-Action Alternative is required under CERCLA because it is used as a baseline to compare alternatives. Under this alternative, no remedial action would be undertaken to treat, contain, or remove contaminated groundwater at IBW-South. No monitoring would be conducted and no institutional controls established.

Some reduction in the volume, toxicity, or mobility of the contaminants would occur as a result of unmonitored natural attenuation processes.

No treatment or containment components would be associated with this alternative. Under the No-Action Alternative, some reduction in risk would occur but it would be unmonitored. The RAOs would not be met for this alternative because contaminants would migrate offsite without reaching MCLs within a reasonable time frame, and protection of human health and the environment would not be achieved.

In addition, chemical-, location-, and action-specific ARARs would not be met.

8.2 Alternative 2–Monitored Natural Attenuation

Under Alternative 2, contamination in the groundwater would be reduced by natural attenuation alone. Groundwater contaminants would be allowed to degrade, dilute, or disperse through naturally occurring physical, chemical, and biological processes. Monitoring to verify

TABLE 9
Results of Solute Transport Analysis for TCE and PCE
1. Will MCLs (in situ groundwater cleanup ARARs) be met within a reasonable time?
2. Does the MCL target volume expand before remediation goals are met?

Contaminant Area	Alternatives 1, 2, 3 No Action, Natural Attenuation, and Limited Action at COT Well No. 7	Alternative 4 Selected Remedy	Alternatives 5, 6 Groundwater Extraction and Treatment of Entire Contaminant Areas in UAU and MAU
UAU Western Contaminant Area (TCE)	1. No. MCLs will not be met within approximately 30 years. 2. The westernmost contaminant area would migrate at least 7,000 feet downgradient.	1. Yes. MCLs could be met within less than approximately 30 years. 2. Contaminant area does not expand.	1. Yes. MCLs are achieved in less than approximately 30 years. 2. Contaminant area does not expand.
UAU Central Contaminant Area (TCE)	1. Yes. MCLs will be met in less than approximately 30 years. 2. Contaminant area would expand less than 500 feet.	1. Same results as Alternatives 1, 2, and 3. 2. Same results as Alternatives 1, 2, and 3.	1. Yes. MCLs are achieved in less than approximately 30 years. 2. Contaminant area does not expand.
UAU Eastern Contaminant Area (PCE)	1. Yes. MCLs will be met within a reasonable time. 2. Contaminant area migrates about 2,000 feet in the UAU.	1.Yes. MCLs could be met in less than approximately 30 years within the entire contaminant area. 2. A portion of the contaminant area migrates approximately 2,000 feet before it reaches MCLs.	1. Yes. MCLs can be met in less than approximately 30 years. 2. Contaminant area does not expand.
MAU-B (TCE)	1. Yes. TCE concentrations would reduce from 11 ppb to below 5 ppb in less than approximately 30 years. 2. MCL contaminant area in MAU-B would expand downgradient less than 2,000 feet.	1. Same results as Alternatives 1, 2, and 3. 2. Same results as Alternatives 1, 2, and 3.	1. Yes. MCLs can be met in less than approximately 30 years. 2. Contaminant area does not expand.
MAU-C (TCE)	1. Yes. TCE concentrations would reduce from 7 ppb to below 5 ppb in less than approximately 30 years. 2. MCL contaminant area in MAU-C would expand downgradient less than 2,000 feet.	1. Same results as Alternatives 1, 2, and 3. 2. Same results as Alternatives 1, 2, and 3.	1. Yes. MCLs can be met in less than approximately 30 years. 2. Contaminant area does not expand.

that these processes are occurring is included in this alternative. The potential for the biological component of the natural attenuation process to be occurring at IBW-South was evaluated in the Groundwater FS. There is not evidence that widespread biodegradation is occurring. The physical processes of dilution and dispersion are the most significant components of natural attenuation at the site.

Groundwater monitoring would be conducted to assess and verify the effectiveness of the natural attenuation processes. Institutional controls would be needed to protect the public from exposure to contaminated groundwater while natural attenuation was taking place. Approximately 50 existing wells would be in the monitoring network. The monitoring program for natural attenuation in this alternative, and as a component in the remaining alternatives, will follow EPA's interim final OSWER Directive 9200.4-17.

Data that may be required as part of a natural attenuation verification program include the following: VOCs; dissolved oxygen (DO); nitrate; ferrous iron (Iron II); dissolved manganese; sulfate; sulfide; methane, ethane, and ethene; alkalinity; oxidation/reduction potential (Redox); pH; temperature; electrical conductivity (EC); chloride; and total organic carbon (TOC).

ARARs would eventually be met in most of the contaminated areas; however, the aquifer cleanup goals would not be met within a reasonable time frame in the western contaminated area. The contaminated area in the MAU would migrate approximately 2,000 feet before TCE concentrations were reduced to the MCL of 5 µg/L. The eastern UAU area of contamination would migrate approximately 2,000 feet before PCE concentrations were reduced to MCLs. The western area of contamination would migrate greater than 7,000 feet before TCE concentrations were reduced to MCLs.

8.3 Alternative 3–Limited Action: Wellhead Treatment at COT No.7/COT Potable Water

The objective of Alternative 3 is to provide a limited action that would allow the City of Tempe to use COT No. 7 to provide water meeting drinking water standards for public water supplies on an as-needed basis.

Under Alternative 3, the well would be used intermittently, and wellhead air stripping would be conducted to remove VOCs from the existing COT No. 7. Following treatment, the treated water would be conveyed by pipeline to the City of Tempe potable water distribution system. Offgas generated from the air stripping process would be treated using VGAC. Routine monitoring of the influent to and effluent from the treatment unit would be conducted to assess operational conditions and to ensure that drinking water standards were achieved. No additional monitoring of the contaminated areas, or of MNA, would be performed. The major components of Alternative 3 are provided in Table 8.

Similar to Alternative 2, ARARs related to drinking water source protection would not be met because the migrating areas of contamination would exceed MCLs in currently uncontaminated areas,and the western area of contamination would not reach MCLs within a reasonable time frame. The migration of the areas of contamination and the risk reduction would be the same as in Alternative 2. The extent of contaminant migration was described in Table 9.

8.4 Alternative 4–Partial Containment: Extraction Wells/ Treatment Plant Air Stripping/Discharge to Town Lake via City of Tempe Storm Drain/Monitored Natural Attenuation

As Described in Proposed Plan

This alternative included extraction of a partial target volume, which was defined as the area of highest VOC-contaminated groundwater from the UAU aquifer in the central and eastern contaminated areas where concentrations are above 20 to 30 µg/L and the entire western UAU contaminated area where VOCs are above MCLs. The partial target volume was developed to establish a volume of water that is less than the regional target volume (defined as groundwater in which VOC concentrations are above the MCLs) which, when pumped and treated and combined with natural attenuation of the remaining portions of the regional target volume, would meet cleanup levels within a reasonable time frame. The partial target volume was established based on extracting the highest levels of contamination in the UAU and performing groundwater modeling to determine if this volume is sufficient to ensure that groundwater MCLs will be met within a reasonable time frame (less than 100 years, as described in the Proposed Plan) without migrating a far distance before cleanup levels are met.

The extracted groundwater within the partial target volume is piped to a centralized treatment system and the VOCs are removed from the groundwater by air stripping. VOC-contaminated offgas from air stripping is treated by using VGAC vessels. The treated water would then be delivered to the City of Tempe storm drain system, the SRP Tempe Canal No. 6, or reinjected to the MAU aquifer. The Proposed Plan stated that the exact end use for the treated groundwater would be determined during remedial design for the remedy.

Routine monitoring of the groundwater before and after treatment would be conducted to assess operational conditions and ensure cleanup goals are met. The portion of the UAU that is not actively pumped and treated, and the MAU aquifer, would migrate a short distance and naturally attenuate to MCLs within a reasonable time frame. EPA had conducted modeling to determine how far portions of the VOC-contaminated areas not treated by air stripping could migrate before reaching cleanup goals through natural attenuation processes. The results, as presented in the FS, were as follows:

- Western UAU contaminated area–The entire contaminated area is hydraulically contained, and therefore does not migrate;
- Central UAU contaminated area–Migrates less than 2,000 feet before meeting MCLs throughout the contaminated area in less than approximately 30 years;
- Eastern UAU contaminated area–Migrates approximately 2,000 feet before meeting MCLs throughout the contaminated area in less than approximately 30 years;
- MAU contaminated area (Subunits B and C)–Migrates less than 2,000 feet before meeting MCLs throughout the contaminated area in less than approximately 30 years.

Newly installed wells, in addition to existing monitoring wells, are sampled to monitor the progress of the decreases in VOC concentrations during the natural attenuation process to ensure that cleanup levels are met.

In situ cleanup ARARs would be met within the portions of the contaminated areas that would be hydraulically contained. Chemical-specific discharge requirements, presented in Table 12, will be met prior to discharge to any one of the three potential end uses. Location-specific ARARs, air quality standards, and waste management ARARs can be met.

Using the validated data through July 1994, ARARs could be met only if a portion of each of the three contaminated areas in the UAU were extracted. However, as described in the following section, extraction is not needed in all three areas when the more recent data are evaluated. The following section describes the selected remedy.

Selected Remedy–Partial Containment: Extraction Wells/Treatment Plant Air Stripping/Discharge to Town Lake, SRP Tempe Canal No. 6, or Aquifer Reinjection/Monitored Natural Attenuation

A brief description of the selected remedy is provided here. Additional information is provided in Sections 9.0, 10.0, and 11.0. As described in those sections, the selected remedy is Alternative 4, as modified on the basis of public comments on the Proposed Plan and results of the groundwater evaluation using data collected through October 1997. Major components of the selected remedy are described in Table 8. Contaminated groundwater will be extracted only from the western contaminated area in the UAU. MNA will be used to meet the RAOs in the remaining portions of the central and eastern contaminated areas in the UAU, and for the entire contaminated area within the MAU.

The exact location of the treatment plant, and the exact end use for extracted groundwater will be determined during remedial design.

All ARARs are expected to be met. The contaminated areas that will not be hydraulically contained are expected to migrate less than 2,000 feet before reaching MCLs, and all groundwater concentrations are expected to reach MCLs within approximately 30 years.

Contingency Remedy–Additional Groundwater Extraction and Treatment

As described in Section 11.0, a contingency remedy exists for the situation in which the MNA portion of the selected remedy does not perform as expected. This contingency remedy will be activated according to the criteria presented in Section 11.0. A brief description of the contingency remedy is provided here. Additional information is provided in Sections 9.0, 10.0, and 11.0. As described in those sections, public comments on the Proposed Plan and the results of the groundwater evaluation using data collected through October 1997 provided the basis for the contingency remedy. Major components of the contingency remedy are described in Table 8.

In addition to the contaminated groundwater that will be extracted from the western contaminated area in the UAU, groundwater will also be extracted from portions of the eastern contaminant area of the UAU or MAU. The area and volume of additional groundwater to be extracted will depend on which of the trigger criteria are exceeded. For costing purposes, it was assumed that a portion of the eastern contaminated area would be extracted and treated. Additional assumptions regarding the cost estimate for the contingency remedy are provided in Appendix A of this ROD. MNA may still be used to meet the RAOs in some portions of the contaminated areas.

The exact location of any additional treatment plant(s), and the exact end use of the additional groundwater that will be extracted, will be determined during remedial design for the contingency remedy.

All ARARs are expected to be met for the contingency remedy. Table 9 lists the estimated cleanup times and migration distances for the contingency remedy.

8.5 Alternative 5—Regional Containment: Extraction Wells/ Treatment Plant Air Stripping/Discharge to SRP Tempe Canal No. 6

The objective of this alternative was to reach aquifer cleanup goals by extraction and treatment of all of the groundwater contaminated above MCLs in each contaminated area. This alternative incorporates discharge of treated water to the SRP Tempe Canal No. 6.

The major components of Alternative 5 are described in Table 8. The conceptual design for Alternative 5 includes eight extraction wells in the UAU and four in the MAU. Similar to Alternative 4, contaminated groundwater would be conveyed by pipeline to a centralized air stripping treatment plant, and offgas would be treated using VGAC. The treated groundwater would be conveyed by pipeline to the SRP Tempe Canal No. 6 for discharge. Routine monitoring of the groundwater before and after treatment would be conducted to assess operational conditions, to ensure that discharge criteria were achieved, and to monitor progress of remediation.

As indicated in Table 9, contaminated groundwater within the areas of contamination is expected to meet cleanup standards within a reasonable time frame of less than approximately 30 years. Groundwater that is extracted will be treated to chemical-specific discharge requirements prior to discharge to SRP Tempe Canal No. 6. The alternative is protective of human health and the environment because the areas of contamination are hydraulically contained and do not migrate. Location-specific ARARs, air quality standards, and waste management ARARs can be met.

8.6 Alternative 6–Regional Containment: Extraction Wells/ Treatment Plant Air Stripping/Aquifer Reinjection

Alternative 6 is similar to Alternative 5, except that the end use of treated groundwater would be reinjection into the MAU. The major components of Alternative 6 are listed in Table 8. Eight reinjection wells would inject the treated groundwater into the MAU. As in Alternative 5, the contaminated groundwater would be conveyed via a new pipeline to a centralized air stripping treatment plant. The offgas would be treated using VGAC. Routine monitoring of the groundwater before and after treatment would be conducted to assess operational conditions and to ensure that cleanup goals were achieved.

As in Alternative 5, all ARARs would be met.

9.0 Comparative Analysis of Alternatives

The Groundwater FS presented the detailed evaluation of each alternative using the nine evaluation criteria listed below. Each of the three potential end-use options was evaluated and included in the selected remedy presented in Section 8 of the Groundwater FS (EPA, 1997c). This section compares the remedial alternatives described in Section 8.0 of this ROD. The comparative analysis provides the basis for determining which alternative presents the best balance among EPA's nine evaluation criteria listed below. The first two cleanup evaluation criteria are considered threshold criteria that must be met by the selected remedial action. The next five criteria are balanced to achieve the best overall solution. The final two modifying criteria that are considered in remedy selection are state acceptance and community acceptance.

- **Threshold Criteria**

  1. *Overall Protection of Human Health and the Environment* addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.

  2. *Compliance with Applicable or Relevant and Appropriate Requirements* addresses whether a remedy will meet all federal and state environmental laws and/or provide grounds for a waiver.

- **Primary Balancing Criteria**

  3. *Long-Term Effectiveness and Permanence* refers to the ability of a remedy to provide reliable protection of human health and the environment over time.

  4. *Reduction of Toxicity, Mobility, or Volume through Treatment* refers to the preference for a remedy that reduces health hazards of contaminants, the movement of contaminants, or the quantity of contaminants through treatment.

  5. *Short-Term Effectiveness* addresses the period of time needed to complete the remedy, and any adverse effects to human health and the environment that may be caused during the construction and implementation of the remedy.

  6. *Implementability* refers to the technical and administrative feasibility of an alternative or a remedy. This includes the availability of materials and services needed to carry out a remedy. It also includes coordination of federal, state, and local government efforts.

  7. *Cost* evaluates the estimated capital and O&M costs of each alternative in comparison to other equally protective alternatives.

- **Modifying Criteria**

  8. *State Acceptance* indicates whether the state agrees with, opposes, or has no comment on the preferred alternative.

  9. *Community Acceptance* includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose.

The strengths and weaknesses of the alternatives and the contingency remedy were weighed to identify the alternative providing the best balance among the nine evaluation criteria. The comparative analysis of the alternatives is provided in the following discussion.

A summary of the results of the comparative analysis of the alternatives and the contingency remedy is provided in Table 10. The comparative cost of each alternative is also depicted graphically in Figure 9. The comparative analysis discussions are organized from the best performing alternatives to the worst performing alternatives within each criterion. Only those factors where there are substantial differences among the alternatives are discussed.

9.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative and the contingency remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls.

Table 10 presented the estimated distances each contaminated area would migrate for each alternative. The table also indicated whether the aquifer could be restored to the MCLs for TCE and PCE, the two main COCs, within a reasonable time frame of approximately 30 years. Alternatives 5 and 6 are marginally more protective of human health and the environment (i.e., the groundwater resource). Under these alternatives, all groundwater contamination exceeding aquifer cleanup standards, the majority of which are MCLs, is hydraulically contained by pumping from extraction wells, and groundwater is restored within a reasonable time frame and more rapidly than other alternatives. No new areas of groundwater would be impacted.

Alternative 4, the selected remedy, is also protective of human health and the environment. Contamination in the western area will be remediated by extraction and treatment within a reasonable time frame. Some portions of groundwater contaminated areas that exceed aquifer cleanup standards will migrate downgradient. However, MNA is expected to reduce contaminant concentrations in those portions of the groundwater so that the groundwater is restored and site risks are reduced within a reasonable time frame. Groundwater monitoring and institutional controls will provide protection of human health and the environment. No currently used groundwater wells are impaired, and aquifer cleanup standards will be reached in approximately 30 years sitewide.

Alternative 2 is less protective than the active remediation actions taken under Alternatives 4, 5, and 6. Alternative 2 relies entirely on MNA and institutional controls to achieve protection of human health and the environment. Under this alternative, more extensive migration into currently uncontaminated areas of the aquifer would occur, and the aquifer would not be restored within a reasonable time frame. Institutional controls would be required over a larger area than in Alternative 4. Alternative 3 provides a very similar level of protection as Alternative 2. The primary difference is the lack of monitoring for Alternative 3.

The No-Action Alternative provides no overall protection to human health or the environment because no monitoring is performed and no institutional controls are put in place to protect the public from exposure to contaminated groundwater.

The contingency remedy is also protective of human health and the environment. It will ensure that migration of contaminants in natural attenuation areas is limited, if necessary, and that aquifer cleanup levels are achieved in a reasonable time frame.

Compliance with ARARs

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. *Relevant and appropriate requirements* are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

As indicated in Table 10, Alternatives 4 (selected remedy), 5, and 6, and the contingency remedy would fully comply with all ARARs (chemical-, location-, and action-specific). Chemical-specific ARARs for aquifer remediation would be achieved within a reasonable time for each of these alternatives.

Aquifer cleanup standards would not be met in a reasonable time for Alternative 2 in the western contaminated area. Modeling indicates that MCLs would be met within a reasonable time frame for the central and eastern areas of UAU contamination and in the MAU. The majority of aquifer cleanup standards are MCLs for the COCs. Alternative 3 is similar to Alternative 2 in its level of compliance with ARARs.

The No-Action Alternative is similar in performance to Alternatives 2 and 3 and would not comply with ARARs. The No-Action Alternative provides the least compliance with ARARs because no institutional controls would be in place to protect the public from groundwater contaminated above regulatory limits, and no monitoring is performed, so the areas of contamination would migrate unchecked. Each of the three potential groundwater end uses and each of the three potential treatment process options would meet ARARs.

Each of the three potential groundwater end uses and each of the potential treatment process options would meet ARARs. The contingency remedy would also comply with ARARs.

9.2 Primary Balancing Criteria

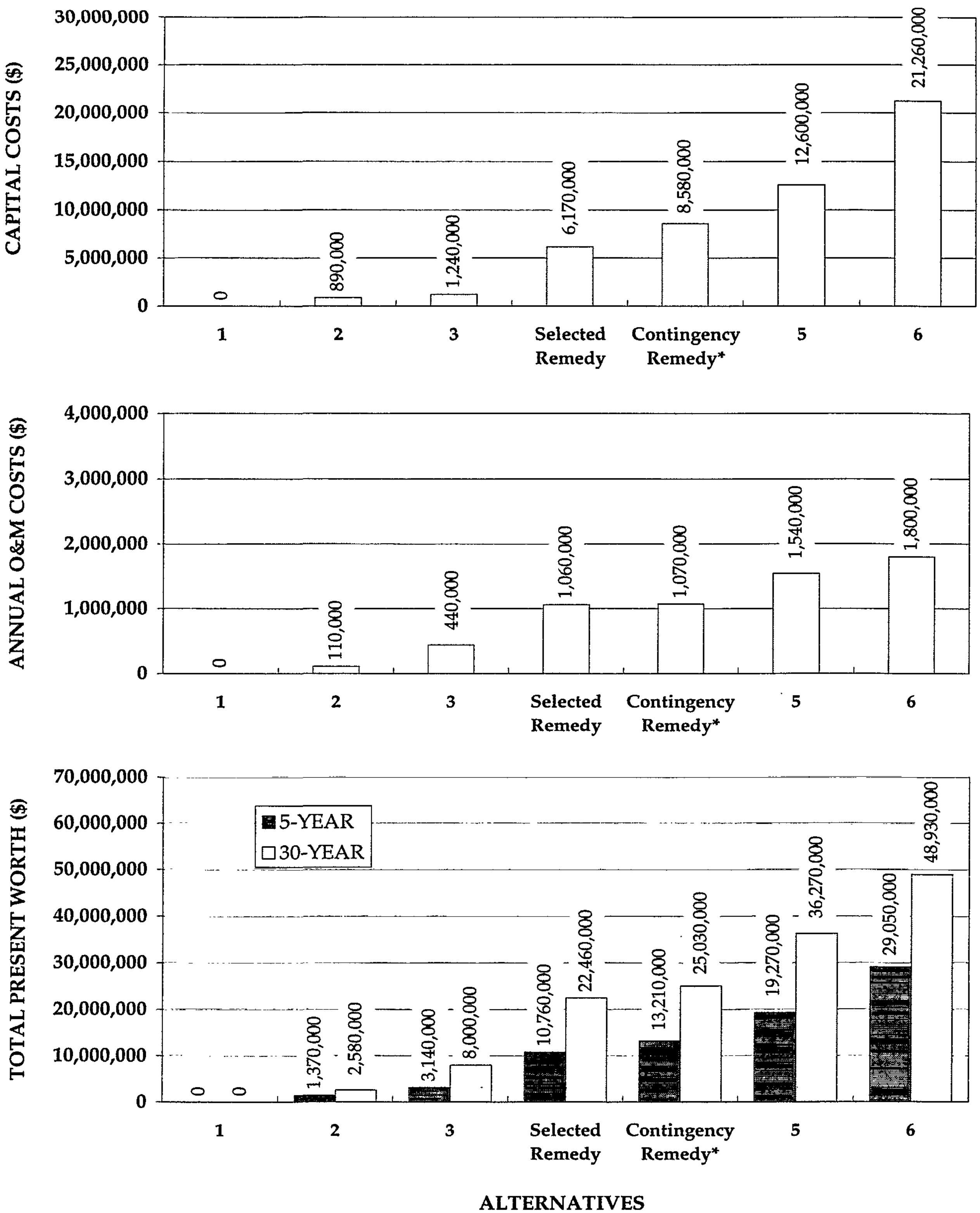
Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

TABLE 10
Comparison of Alternatives with EPA's Nine Evaluation Criteria

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4 (EPA's Selected Remedy)	Contingency Remedy	Alternative 5	Alternative 6
Alternative Description	No-Action	Natural Attenuation: Well Permit Requirements/ Groundwater Use Restrictions/ Groundwater and Verification Monitoring	Limited Action: Wellhead Treatment at COT No. 7/ COT Potable Water: Well Permit Requirements/ Groundwater Use Restrictions/Groundwater Monitoring	Partial Containment/ Treatment/COT Storm Drain leading to Town Lake/ Natural Attenuation Well Permit Requirements/ Groundwater Use Restrictions/Groundwater Monitoring	Additional extraction and treatment	Regional Containment/ Treatment/Tempe Canal No. 6 Well Permit Requirements/ Groundwater Use Restrictions/ Groundwater Monitoring	Regional Containment/ Treatment/Aquifer Reinjection/Well Permit Requirements/ Groundwater Use Restrictions/Groundwater Monitoring
Overall Protection of Human Health and the Environment	No	No; aquifer cleanup standards will not be met in the UAU in a reasonable time frame.	No; treated drinking water from COT No. 7 would pose no risks, but contaminated areas will migrate and will not be monitored.	Yes; groundwater extraction and MNA will limit migration, and aquifer cleanup standards will be met in a reasonable time frame.	Same as Alternative 4.	Same as Alternative 4.	Same as Alternative 4.
Compliance with ARARs	No	No; aquifer cleanup standards will not be met in the UAU in a reasonable time frame.	No; same as Alternative 2.	Yes.	Yes	Yes.	Yes.
Long-Term Effectiveness and Permanence	No, does not reduce long-term risk	No; same as Alternative 1	No; same as Alternative 1.	Yes; long-term risks are greatly reduced.	Same as Alternative 4.	Same as Alternative 4.	Same as Alternative 4.
Reduction of Toxicity, Mobility, or Volume through Treatment	None	None	Very little reduction of toxicity, mobility, or volume when treatment occurs at COT No. 7.	Yes; toxicity and volume are greatly reduced throughout the contaminated area. Mobility is greatly reduced in the area of highest contamination.	Yes; toxicity and volume are greatly reduced throughout the contaminated area. Mobility is greatly reduced in the area of highest contamination.	Yes; toxicity, mobility, or volume throughout contaminated area are reduced.	Same as Alternative 5.
Short-Term Effectiveness	Not applicable	Construction-related risks can be minimized.	Same as Alternative 2.	Additional short-term risks from construction of treatment plant and piping.	Slightly more construction than Alternative 4, but less than Alternatives 5 and 6.	Short-term risks greater than Alternative 4 resulting from larger treatment plant and more piping.	Same as Alternative 5.
Implementability	Not applicable	Yes; equipment and services are readily available.	Yes; the treatment technology is proven, reliable, and readily available.	Yes; the treatment technology is proven, reliable, and readily available. Installation of pipeline may be difficult because of existing conditions.	Same as Alternative 4.	Yes; Same as Alternative 4, except that the Pipeline is more extensive and will result in greater construction impacts than Alternative 4 and the contingency remedy.	Same as Alternative 5.
Cost Capital Cost Annual O&M Cost 30-Year Present Worth	 $0 $0 $0	 $890,000 $110,000 $13,950,000	 $1,240,000 $440,000 $8,000,000	 $6,170,000 $1,060,000 $22,460,000	 $2,410,000 (additional)[a] $10,000 (additional)[a] $2,570,000 (additional)[a]	 $12,600,000 $1,540,000 $36,270,000	 $21,260,000 $1,800,000 $48,930,000

[a]Additional to the cost of Alternative 4, the selected remedy.



Note: *Costs presented fo the Contingency Remedy represent the total combined costs for Alternative 4 (Selected Remedy) and the additional costs for the Contingency Remedy

FIGURE 9
COMPARATIVE COST OF ALTERNATIVES
INDIAN BEND WASH-SOUTH GROUNDWATER OU ROD

Magnitude of Residual Risk—Alternatives 4, 5, and 6, and the contingency remedy have the lowest magnitude of residual risk. Under these alternatives, extraction and treatment and MNA of contaminated groundwater exceeding aquifer cleanup standards will reduce residual risk to acceptable levels within a reasonable time of approximately 30 years. Untreated residual contamination in groundwater will not pose a risk to human health.

Alternative 2 is higher than Alternative 4 in the magnitude of residual risk during the life of the remedy because no contaminated groundwater is extracted and treated. Alternative 2 relies entirely on natural attenuation to reduce contaminant concentrations, and they will not be met in the western area of contamination within a reasonable time frame. Similar to the other alternatives, the untreated residual contamination will not pose a risk to human health because monitoring and institutional controls will be implemented.

Alternative 3 is similar to Alternative 2 in the magnitude of residual risk.

The magnitude of residual risk under the No-Action Alternative is higher than for the other alternatives because no actions are taken to remediate contamination, and no monitoring or institutional controls would be in place to protect the public from exposure to contaminated groundwater.

Adequacy and Reliability of Controls–Alternatives 4, 5, and 6, and the contingency remedy use pump and treat processes that are well-established, reliable, and capable of meeting performance requirements. No difficulties associated with the long-term operation of these alternatives are anticipated. VGAC carbon replacement and routine maintenance of air stripping towers, UV/Ox systems, and extraction wells will be required, but these are standard operating procedures. Long-term monitoring will assess and ensure the adequacy of the alternatives at meeting cleanup objectives. The long-term reliability of institutional controls is somewhat less certain. Institutional controls are subject to changes in political jurisdiction, legal interpretation, and enforcement.

Under Alternatives 2 and 4, the adequacy and reliability of the MNA portion of each alternative to meet cleanup goals is somewhat less certain than the pump and treat actions taken under Alternatives 5 and 6, but MNA is expected to reach cleanup levels in a reasonable time frame in the central and eastern contaminated areas. However, by setting the contingency criteria to activate pump and treat, Alternative 4 is more reliable in meeting cleanup goals if MNA fails. Alternative 2 is less reliable because, unlike Alternative 4, it does not include extraction in the western contaminated area.

Alternative 3 is similar to Alternatives 4, 5, and 6 with respect to the pump and treat aspect of the alternative. Wellhead air stripping and VGAC treatment of offgas are well-established and reliable processes. However, Alternative 3 only addresses contaminated groundwater at COT No. 7 (a much smaller volume) and not overall groundwater contamination at IBW-South, and would be operated only sporadically.

The No-Action Alternative is inadequate and not reliable because no actions are taken, and no monitoring is conducted.

Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Treatment Processes Used and Materials Treated–Alternatives 4, 5, and 6 and the contingency remedy would use treatment trains which may consist of air stripping with VGAC, LGAC, or UV/Ox. Alternative 3 would use a treatment train assumed to consist of air stripping and VGAC treatment of offgas to treat VOC-contaminated groundwater.

Under the No-Action Alternative and Alternative 2, no treatment processes are used.

Degree of Expected Reductions in Toxicity, Mobility, or Volume–Under Alternatives 4, 5, and 6, and the contingency remedy, air stripping, LGAC, or UV/Ox will remove 99.9 percent of the VOCs in the groundwater extracted from the aquifer. The volume of contaminated groundwater at concentrations exceeding aquifer cleanup standards is hydraulically contained and gradually reduced through groundwater pumping.

Alternative 3 is a limited action that will not provide significant reductions in the toxicity, mobility, or volume of groundwater contamination at IBW-South. This alternative will provide some minor reduction in the volume of contaminants through occasional pumping of COT No. 7 and operation of the treatment system, but this is considered insignificant. Alternative 3 is similar to Alternative 2, in that the majority of reductions in contaminant toxicity in the aquifer will only occur as the result of naturally occurring processes. Migration of contaminated groundwater will be similar to Alternative 2.

The No-Action Alternative does not provide any reduction in toxicity, mobility, or volume through active treatment.

Degree to Which Treatment is Irreversible–Under Alternative 3, air stripping with VGAC, and under Alternatives 4, 5, and 6, air stripping with VGAC adsorption of contaminants in the offgas, LGAC treatment are inherently irreversible treatment processes as long as the spent carbon is properly disposed of offsite.

Type and Quantity of Treatment Residual–Under Alternatives 3, 4, 5, and 6, it is assumed that air stripping treatment would transfer VOCs to air, and this offgas generated from the air stripping would be treated using VGAC. It is possible that LGAC, UV/Ox may be used as the treatment option for the selected alternative. However, the calculations of spent carbon for the alternatives is based on use of air stripping with VGAC offgas treatment. The quantity of spent carbon under each alternative is as follows, in declining order:

- Alternative 6–160,000 pounds per year
- Alternative 5–150,000 pounds per year
- Contingency remedy–67,000 pounds per year
- Alternative 4 (selected remedy)–44,000 pounds per year
- Alternative 3–unknown, because the amount of intermittent pumping at COT No. 7 cannot be estimated (but it is much less than the quantity generated under Alternative 4)
- No treatment residuals are generated under the No-Action Alternative and Alternative 2.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

Protection of Community and Workers During Remedial Action—Alternative 2 poses only minimal risks to the community and workers associated with the installation of natural attenuation monitoring wells.

Alternative 3 involves construction of a wellhead treatment unit, consisting of an air stripper and VGAC adsorption vessels, at the COT No. 7. The minimal risk posed to the community is similar to that posed by Alternative 2. Discharges from the treatment unit will meet local air district emissions requirements.

Because of the additional construction activities under Alternatives 4, 5, and 6, slightly higher risks are posed than under Alternatives 2 and 3. However, the risks to the community are still fairly minimal if proper health and safety procedures are followed. Alternative 4 and the contingency remedy pose less risk than Alternatives 5 and 6 because there is less construction.

Environmental Impacts—Alternatives 2 and 3 pose only minimal risks to the environment associated with the installation of natural attenuation monitoring wells. Good work practices will provide environmental protection during remedial action activities. Discharges from the treatment unit installed for Alternative 3 will meet local air district emissions requirements that are set to be protective of the environment.

Alternatives 4, 5, and 6, and the contingency remedy all involve construction of a treatment plant(s) using air stripping/VGAC, LGAC, or UV/Ox treatment, installation of conveyance pipeline, and installation of extraction and monitoring wells. Because of the additional complexity and scope of these alternatives, slightly higher environmental risks are posed than under the simpler actions taken under Alternatives 2 and 3. However, similar to Alternatives 2 and 3, the risks to the environment are still expected to be minimal. Risks posed by Alternative 4 would be slightly less than Alternatives 5 and 6 because there is less construction. Alternative 6 may pose more risks than Alternative 5 because it requires construction of an injection well. Discharges from the treatment unit will meet local air district emissions requirements that are set to be protective of the environment. Similarly, discharge of treated groundwater will comply with appropriate regulations for discharge to surface water or aquifer reinjection.

Alternative 4 has fewer short-term environmental impacts because a considerably smaller volume of groundwater is extracted, treated, and disposed of. Therefore, less groundwater is disturbed, less energy is used in treating it, fewer treatment residuals are created, and less disposal capacity is used.

Time Until Remedial Objectives are Achieved–The estimated times until cleanup goals will be achieved under each alternative were presented in Table 10 and are as follows:

- Alternatives 4, 5, and 6–less than approximately 30 years for UAU and MAU
- Alternative 2–The western area of contamination UAU will require more than 100 years to meet MCLs; MCLs will be met in the MAU within approximately 30 years.

- Alternative 3 and the No-Action Alternative–similar to Alternative 2, except no monitoring is conducted to assess progress towards cleanup.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Ability to Construct and Operate the Technology and Reliability of the Technology–All of the alternatives are expected to be readily constructed and operated using reliable technologies. Although the natural attenuation technology is less proven than the pump and treat technologies, it is expected to be reliable.

Alternatives 4, 5, and 6, and the contingency remedy all involve construction of air stripping/VGAC, LGAC, or UV/Ox treatment plant, installation of conveyance pipelines, and installation of extraction and monitoring wells. Alternative 6 also involves installation of groundwater injection wells. Because of the additional complexity and scope of these alternatives, more difficulties during construction will likely be encountered than under the simpler actions taken under Alternatives 2 and 3. Alternative 4 presents fewer implementation problems than Alternatives 5 and 6 because considerably less construction is necessary in MNA areas. However, the active treatment components of Alternatives 4, 5, and 6 are commonly employed and not exceptionally difficult to construct or operate. Because IBW-South is in a developed industrial/commercial area, difficulties may arise associated with the installation of conveyance pipelines. Complications caused by obtaining required utility clearances, implementing traffic controls, and obtaining easements may also be encountered. Such implementability difficulties are likely to be somewhat more significant for Alternatives 5 and 6 than Alternative 4 because active measures and pipeline cover greater area.

Pilot testing of the groundwater injection wells installed under Alternative 6 may be required. Operation of the extraction/treatment/aquifer reinjection system under Alternative 6 makes this alternative the most difficult to construct and operate.

Ability to Monitor Effectiveness of Remedy–No difficulties in the ability to monitor the effectiveness of the remedy are anticipated under Alternatives 2, 4, 5, and 6, and the contingency remedy. Groundwater monitoring will be conducted to monitor the effectiveness of the remedy at reducing contaminant concentrations. For Alternatives 3, 4, 5, and 6, treatment plant air and water effluent monitoring will be conducted without significant difficulty to ensure that discharge requirements are met. For Alternative 6, water level measurements will also be routinely collected to evaluate the extent of groundwater mounding near injection wells.

Alternative 3 is a limited action with limited monitoring compared with that conducted under Alternatives 2, 4, 5, and 6, and the contingency remedy. No difficulties are anticipated in conducting this monitoring. Wellhead treatment plant air and water effluent monitoring will be conducted to ensure that discharge requirements are met.

Coordination with Other Agencies–Under each of the other alternatives, considerable coordination between EPA, ADEQ, ADWR, City of Tempe, and SRP will be required. The level of effort required to accomplish this coordination for each alternative is uncertain. The interagency coordination issues include the following.

Under Alternative 2, EPA will need to coordinate with state and local agencies including ADWR, ADEQ, and the City of Tempe (e.g., to obtain necessary substantive permit requirements). Natural attenuation engineering evaluations will be performed and provided to agencies to ensure that future institutional controls are considered and implemented by state and local authorities to protect the public from VOC-contaminated groundwater.

Under Alternative 3, EPA will need to coordinate with state and local agencies including ADWR, ADEQ, and City of Tempe with regard to the community water supply that may be provided from COT No. 7 in the event of an emergency.

Under Alternatives 4, 5, 6, and the contingency remedy, the above coordination as described in Alternative 2 is required. In addition, if groundwater is extracted from within the SRP service area and used outside the service area (i.e., Town Lake), discussions will be held with SRP to consider water quality issues, water rights, water accounting, cost, liability, and operational concerns. These water rights issues will not affect implementation of the alternative, but could affect budget and schedule. Coordination between EPA and ADEQ will be required concerning substantive water quality requirements for discharge to Town Lake, if this is the end use determined during remedial design. Coordination between SRP and EPA will be required concerning substantive water quality requirements for discharge of treated groundwater to SRP Tempe Canal No. 6. Coordination between SRP and EPA will be required if treated groundwater is injected within the SRP service area. Additional coordination with ADEQ and DWR may be required on groundwater resource protection issues.

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity–Under Alternatives 2, 4, 5, and 6, and the contingency remedy, contaminated groundwater that is purged from monitoring wells during verification sampling will be disposed of in the City of Tempe sanitary sewer system if the discharge requirements are met.

For Alternatives 3, 4, 5, and 6, a vendor will be used to remove, transport, and dispose of spent carbon from VGAC or LGAC units. These types of vendors are readily available and have sufficient capacity to handle the volume of carbon to be used at IBW-South.

The amount of treated groundwater to be discharged under Alternative 4 and the contingency remedy is potentially less than that for Alternatives 5 and 6. The discharge end-use options under consideration will be able to accommodate the maximum estimated flow rate from the treatment plant(s) under normal conditions. However, if Town Lake is selected as the end use of Alternative 4 (selected remedy), the capacity of the existing storm sewer system to convey treated groundwater to Town Lake may be reduced during storm events, potentially affecting full flow capacity for storm runoff.

Cost

Table 11 lists the capital, annual O&M, and present worth costs for each alternative. The estimated 30-year present worth for the alternatives, not including the No-Action Alternative, ranges from $2.6 million for Alternative 2 to $48.9 million for Alternative 6.

TABLE 11
Cost

	Capital Cost ($)	Annual O&M Cost ($)	30-Year Total Present Worth ($)	5-year Total Present Worth ($)
Alternative 1	0	0	0	0
Alternative 2	890,000	100,000	2,580,000	1,370,000
Alternative 3	1,240,000	440,000	8,000,000	3,140,000
Alternative 4 (Selected Remedy)	6,170,000	1,060,000	22,460,000	10,760,000
Alternative 5	12,600,000	1,540,000	36,270,000	19,270,000
Alternative 6	21,260,000	1,800,000	48,930,000	29,050,000
Contingency Remedy[a]	2,410,000	10,000	2,570,000	2,450,000

[a] The cost of the components that would be in addition to the cost of Alternative 4, the selected remedy.

The cost of each alternative increases as the volume of groundwater to be extracted and treated increases. Alternatives 5 and 6 do not provide a significant increase in protectiveness over Alternative 4; the portions of contaminated groundwater that will not be extracted with the selected remedy will be remediated using MNA. The MNA in central and eastern areas will meet the same RAOs in the same time period, and will be equally protective, as Alternatives 5 and 6, but at a greatly reduced cost. The selected alternative costs approximately $14 million less than Alternative 5.

9.3 Modifying Criteria

State Acceptance–The State of Arizona prefers Alternative 4 (selected remedy) with the option to employ the contingency remedy, as needed, over the remaining alternatives because this alternative restores the groundwater resource without extracting large quantities of groundwater and because it is more cost-effective than Alternatives 5 and 6, while still being protective of human health and the environment and meeting ARARs within a reasonable time frame of approximately 30 years.

Community Acceptance–The community has expressed concern about using the SRP Tempe Canal No. 6 as an end use for treated groundwater. The community generally supports Alternative 4 more than Alternatives 5 and 6 because it is more cost-effective, and it extracts a smaller volume of groundwater while still meeting aquifer cleanup goals within a reasonable time frame of approximately 30 years and at a reduced cost.

10.0 Explanation of Significant Differences

10.1 Difference in Selected Remedy

The selected remedy is Alternative 4 (presented in the FS) with minor modifications. The selected remedy differs from Alternative 4 with adjustments in the volume and area of the partial target volume to be extracted and treated, the addition of a contingency remedy, the revision of the time period in which EPA expects the groundwater to meet aquifer cleanup goals, and a lower cost. EPA's modeling has shown that it is no longer necessary to include portions of the central and eastern areas of contamination in the partial target volume for extraction and treatment. MNA alone should be sufficient to meet EPA cleanup objectives in these areas.

In the groundwater FS, EPA estimated partial and regional target volumes to evaluate a range of alternatives that might achieve EPA's remedial action objectives. The regional target volume represents the volume of groundwater in the UAU and MAU areas of contamination estimated to be above MCL concentrations. The partial target volume represented a volume that would be necessary to extract and treat, when combined with MNA of lesser contaminated areas of groundwater, that would meet MCLs within a reasonable time frame of 30 to 50 years with limited migration to 2,000 feet beyond the estimated extent of the central and eastern areas of contamination.

The preferred remedy of Alternative 4 in the Proposed Plan specified extraction and treatment of the partial target volume that included all of the western area of contamination above 5 ppb, the MCLs for TCE and PCE, and extraction and treatment of only the most highly VOC-contaminated portions of the central and eastern areas of contamination. The partial target volumes presented in the Proposed Plan were based on groundwater data collected through July 1994. EPA stated in the Proposed Plan that the target volumes were based on modeling performed in the FS and that additional work would be necessary during remedial design to further refine the target volumes.

EPA received several comments on the Proposed Plan centered around the use of older data (data collected through July 1994) to model target volumes of VOC-contaminated groundwater for extraction and treatment and areas for MNA. EPA anticipated the need to modify the partial target volumes during remedial design, but because of the lapse of time between release of the FS and the issuance of this ROD, EPA performed modeling to evaluate more recent data. EPA has presented these results here in this ROD and in the Technical Memorandum *Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models*, dated August 12, 1998, which is available in the site Administrative Record.

The results of the updated modeling effort show that extraction and treatment are still necessary for all of the western area of contamination. However, MNA of the central and eastern areas of contamination in the UAU will be sufficient to meet MCLs within a reasonable time frame of approximately 30 years and will allow only limited migration of contaminated groundwater to approximately 2,000 feet.

As a result of this review and modeling of more current data, EPA therefore has modified Alternative 4 by changing the volume of contaminated groundwater that will be extracted and treated. The selected remedy eliminates the extraction of groundwater from the central and eastern areas of contamination. Those areas will be remediated by MNA.

EPA has revised the time period to meet cleanup objectives to approximately 30 years based on comments submitted during the public comment period, because all modeling evidence indicates that cleanup levels can be met within this time frame. EPA believes this is a reasonable time given the current contaminant concentrations and other circumstances at the site in which to expect aquifer cleanup goals to be met.

Another change to the preferred remedy set forth in the Proposed Plan is the addition of a contingency remedy to ensure that cleanup goals are met within the central and eastern UAU areas of contamination and the MAU, where MNA is the remedy. EPA has developed a contingency remedy and specific criteria which, if exceeded, will activate the contingency remedy of extraction and treatment of partial target volumes of the central and/or eastern UAU areas of contamination and/or the MAU areas of contamination to meet the performance standards.

Contingency Remedy

A contingency remedy of extraction and treatment of appropriate target volumes of contaminated groundwater in MNA areas will be triggered to satisfy the following two criteria: (1) attaining aquifer cleanup standards within a reasonable time frame of approximately 30 years, and (2) preventing migration of groundwater contaminated above the aquifer cleanup standards to and beyond the compliance boundaries. The appropriate "target volume" of contaminated groundwater to be extracted and treated will be determined to ensure that these two criteria are met.

The compliance boundary for the central and eastern UAU areas of contamination is located approximately 2,000 feet south of Broadway Road, bounded by Price Road to the east and Dorsey Lane to the west. Sentinel wells will be located in the UAU upgradient of the UAU compliance boundary in an area bounded by Broadway Road to the north, approximately 1,000 feet south of Broadway Road to the south, approximately 1,000 feet east of Price Road to the east, and Dorsey Lane to the west. The compliance boundaries are shown on Figure 10.

The compliance boundary for the MAU areas of contamination is located approximately 2,000 feet east of the current extent of VOC contamination and is bounded by Rio Salado Parkway to the north and Apache Boulevard to the south. Sentinel wells will be located approximately 1,000 feet upgradient of the MAU compliance boundary, as shown on Figure 10. The sentinel wells will be monitored at least quarterly.

For the UAU or MAU, the contingency remedy will be triggered if either one of the following situations occurs:

(a) If verification sampling at the sentinel wells confirms that data collected during quarterly sampling exceed the aquifer cleanup standards, and if the average contaminant concentration collected from the next two consecutive quarterly sampling rounds from this well exceeds the aquifer cleanup standards, then the contingency remedy will be activated. The contingency remedy may be implemented sooner, if needed.

(b) EPA-approved flow and transport modeling will be conducted using data collected during each EPA 5-year review period. If the modeling evaluation indicates that the MNA remedy will not attain aquifer cleanup standards within a reasonable time frame of approximately 30 years from the start of remedial action, then the contingency remedy will be activated.

10.2 Differences in Cost

Modifying the remedy presented in the Proposed Plan with a potential contingency remedy to allow for MNA in the central and eastern UAU areas of contamination has allowed the costs for the selected remedy to be reduced as follows.

The capital cost of the selected remedy decreased by $2.15 million (from $8.32 million to $6.17 million) because of the reduction in the number of extraction wells, the length of conveyance piping, and the changes in the treatment requirements. The annual O&M cost decreased by $240,000 (from $1.3 million to $1.06 million) because of lower power requirements and less O&M required for the extraction wells. The 30-year total present worth cost decreased by more than 20 percent, from $28.3 million to $22.46 million.

The costs for the contingency remedy were not presented in the FS. These costs are discussed in Chapters 9.0 and 11.0 of this ROD.

10.3 Potential Differences in End Use of Treated Water

In the Alternative 4 presented in the Proposed Plan, the name of the alternative included Town Lake as the discharge location. The Proposed Plan did state that the exact end use would be determined during remedial design. EPA has proposed in the selected remedy to discharge extracted groundwater, once it has been treated to health-based levels, to one of the following three places: City of Tempe Town Lake, groundwater reinjection to the MAU, and the SRP Tempe Canal No. 6.

Several comments were received during the comment period concerning discharge of the treated groundwater to the SRP Tempe Canal No. 6 because of the potential for water from this canal to be used as a source of drinking water. Groundwater would be treated to meet the standards for protection of drinking water sources as specified in Section 12 before it enters the canal. EPA will consider eliminating this discharge option from the list of possible end-use options when the end-use determination is made during the remedial design phase. EPA intends to keep the community involved during the selection of end use of treated groundwater.

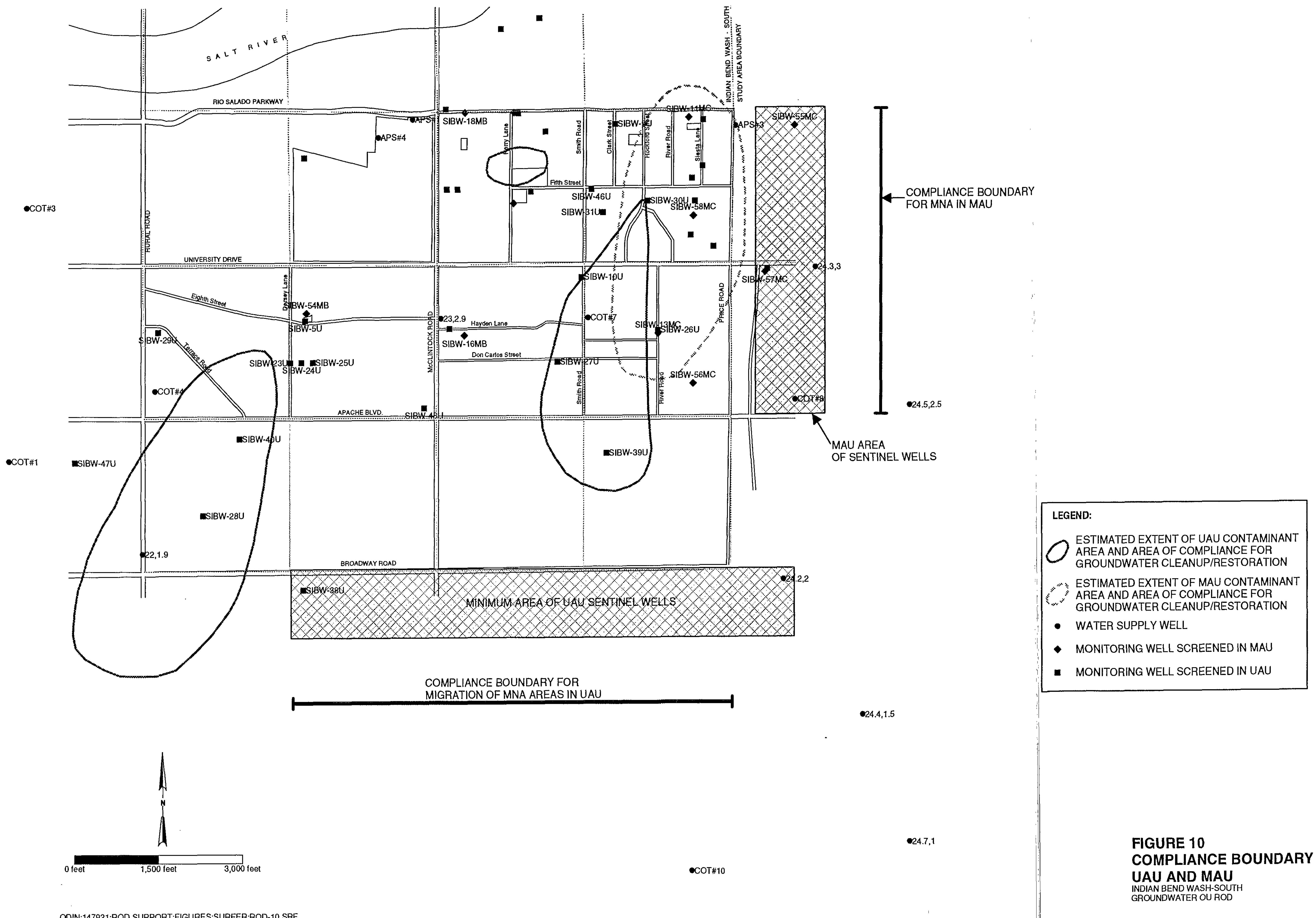


FIGURE 10
COMPLIANCE BOUNDARY FOR UAU AND MAU
INDIAN BEND WASH-SOUTH
GROUNDWATER OU ROD

11.0 Selected Remedy

After considering CERCLA's statutory requirements, the detailed analysis of alternatives for IBW-South, and the public comments on the Proposed Plan, EPA, in consultation with the State of Arizona, has determined that the most appropriate remedy for VOCs in groundwater at IBW-South includes the following:

- Extraction of the western UAU area of VOC-contaminated groundwater to attain aquifer cleanup standards and hydraulic containment of the contaminated areas to inhibit both lateral and vertical migration

- Treatment of extracted water to performance standards using liquid granular activated carbon (LGAC), air stripping with vapor granular activated carbon (VGAC), or ultraviolet light oxidation (UV/Ox)

- Discharge of treated groundwater to the City of Tempe storm drain system leading to Town Lake, the SRP Tempe Canal No. 6, or reinjection.

- MNA of the central and eastern UAU areas of VOC-contaminated groundwater and the MAU areas of VOC-contaminated groundwater to attain aquifer cleanup standards within those areas, and to prevent migration of groundwater contaminated above the aquifer cleanup standards to and beyond the compliance boundaries established in this ROD.

- The establishment of compliance boundaries for those areas where the MNA remedy is selected. The compliance boundaries represent borders beyond which VOC-contaminated groundwater above aquifer cleanup standards will not be allowed to migrate. The compliance boundary for the central and eastern UAU areas of contamination is located approximately 2,000 feet south of Broadway Road, bounded by Price Road to the east and Dorsey Lane to the west. Sentinel wells will be located in the UAU upgradient of the UAU compliance boundary in an area bounded by Broadway Road to the north, approximately 1,000 feet south of Broadway Road to the south, approximately 1,000 feet east of Price Road to the east, and Dorsey Lane to the west. The location of the compliance boundaries and areas for sentinel wells are shown in Figure 10 in Section 10.0. The sentinel wells will be monitored at least quarterly for the hazardous substances for which aquifer cleanup standards are established (see Section 12.0), and for other substances as appropriate.

  The compliance boundary for the MAU areas of contamination is located approximately 2,000 feet east of the current extent of VOC contamination and is bounded by Rio Salado Parkway to the north and Apache Boulevard to the south. Sentinel wells will be located approximately 1,000 feet upgradient of the MAU compliance boundary, as shown in Figure 10 in Section 10.0. The sentinel wells will be monitored at least quarterly for the chemicals for which aquifer cleanup standards are established (see Section 12.0), and for other substances as appropriate.

- Continued monitoring of groundwater to verify the effectiveness of the extraction and treatment and MNA remedies and to ensure that aquifer cleanup goals are met throughout the areas of VOC contamination.

- Institutional controls to protect the public from exposure to contaminated groundwater exceeding aquifer cleanup levels until cleanup levels are met. Institutional controls will include various Arizona well siting, permitting, and construction restrictions, and notices distributed by the ADWR, Arizona Department of Health Services, or EPA concerning risks from exposure to contaminated groundwater. Additional institutional controls to prevent interference with EPA's remedial efforts also may be established.

- Sealing or abandonment of Well SRP23E, 2.9N to eliminate this potential path of VOC contaminant migration from the UAU to the MAU. This well is located in an area of shallow contamination and represents a potential conduit for downward contaminant migration. Other monitoring wells that will not be included in the long-term monitoring network will be abandoned as appropriate.

Contingency Remedy

A contingency remedy of extraction and treatment of appropriate target volumes of contaminated groundwater in MNA areas may be triggered to satisfy the following two criteria: (1) attaining aquifer cleanup standards within a reasonable time frame of approximately 30 years, and (2) preventing migration of groundwater contaminated above the aquifer cleanup standards to and beyond the compliance boundaries. The appropriate "target volume" of contaminated groundwater to be extracted and treated will be determined to ensure that these two criteria are met.

For the UAU or MAU, the contingency remedy will be triggered if either one of the following situations occurs:

(a) If verification sampling at the sentinel wells confirms that data collected during quarterly sampling exceed the aquifer cleanup standards, and if the average contaminant concentration collected from the next two consecutive quarterly sampling rounds from this well exceeds the aquifer cleanup standards, then the contingency remedy will be activated. The contingency remedy may be implemented sooner, if needed.

(b) EPA-approved flow and transport modeling will be conducted using data collected during each EPA 5-year review period. If the modeling evaluation indicates that the MNA remedy will not attain aquifer cleanup standards within a reasonable time frame of approximately 30 years from the start of remedial action, then the contingency remedy will be activated.

Both the selected groundwater remedy and the contingency remedy meet the two NCP threshold evaluation criteria of overall protection of human health and the environment and compliance with ARARs, provide the best balance of tradeoffs based on the primary balancing criteria, and are acceptable to the State of Arizona and the community.

The groundwater cleanup (including groundwater extraction and MNA), treatment and discharge, and additional components of the selected remedy and the contingency remedy are described in the following subsections. The ARARs for the selected remedy are described in Section 12.

11.1 Groundwater Restoration Component

This section describes the groundwater restoration components of the selected remedy. Both groundwater extraction and MNA are described in this section, along with associated performance standards and contingency actions.

Groundwater Extraction

The groundwater extraction component of the selected remedy addresses containment and cleanup of VOC-contaminated groundwater in the western area of the UAU. Groundwater extraction will be used to remediate groundwater that is contaminated in excess of groundwater cleanup standards. It will also prevent migration of the contaminated area. Approximately three wells will be installed and screened in the UAU to extract contaminated groundwater. Modeling reported in the FS and more recent modeling show that without extraction and treatment, PCE and TCE, the main COCs, would migrate 7,000 feet.

Performance Standards and Compliance Monitoring

The groundwater extraction component of the groundwater remedy will be operated until groundwater no longer exceeds the aquifer cleanup standards throughout the contaminated area. Groundwatr extraction will also contain the plume, and the compliance boundary for this portion of the remedy is the extent of contaminated groundwater above the aquifer cleanup standards throughout the western UAU contaminated area.

Water levels will be monitored in monitoring wells to show that the groundwater extraction system is controlling the horizontal and vertical migration of groundwater contaminated above aquifer cleanup levels. If the groundwater extraction containment system is not effective in the western UAU, additional measures will be implemented to ensure that performance standards are met. Examples of such measures may include, but are not limited to, any of the following: more closely spaced extraction wells to facilitate containment or higher extraction rates to increase hydraulic control and expedite restoration. EPA may also determine that more extensive groundwater monitoring is required to ensure that downgradient VOC concentrations in currently clean areas are not increasing.

Monitored Natural Attenuation

As described in Section 10.0, EPA's modeling has shown that MNA alone should be sufficient to meet EPA cleanup objectives in the central and eastern UAU and MAU areas of contamination.

The objective of the MNA component of the remedy is to allow contaminant concentrations in groundwater in the eastern and central UAU and the MAU areas of contamination to be reduced to groundwater cleanup standards within all contaminated areas above aquifer cleanup standards and within a reasonable time frame of approximately 30 years. Natural attenuation reduces contaminant concentrations by dispersion, dilution, biodegradation, and related natural processes. As discussed below, it is anticipated that MNA will accomplish these goals before contaminated groundwater above aquifer cleanup standards reaches the compliance boundaries. The compliance boundaries represent borders beyond which VOC-contaminated groundwater above aquifer cleanup standards will not be allowed to migrate. The compliance boundary for the central and eastern UAU areas of contamination is located approximately 2,000 feet south of Broadway Road, bounded by Price Road to the east and Dorsey Lane to the west. The compliance boundary for the MAU areas of contamination is located approximately 2,000 feet east from the current downgradient extent of VOC contamination at the MCLs and is bounded by Rio Salado Parkway to the north and Apache Boulevard to the south. These boundaries are depicted in Figure 10 in Section 10.

For the contaminated areas where MNA will be implemented, the following are estimates based on EPA modeling presented in this ROD of how far the contamination may migrate beyond its current extent and when the groundwater will meet MCLs for TCE and PCE, the two main COCs:

- Central UAU area of contamination–Recent data indicate that groundwater concentrations do not exceed MCLs.
- Eastern UAU area of contamination–Migrates approximately 2,000 feet before meeting MCLs throughout the area in less than approximately 30 years
- MAU area of contamination (Subunits B and C)–Migrates less than 2,000 feet before meeting MCLs throughout the area in less than approximately 30 years.

New and existing monitoring wells will be sampled to monitor the progress of the decreases in VOC concentrations during the natural attenuation process to ensure that cleanup levels are met and to determine if the contingency remedy trigger criteria (described below) have been exceeded.

MNA will encompass EPA's guidelines on *Use of Monitored Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites* (OSWER Directive 9200.4-18 Interim Final as published in the Federal Register December 8, 1997.

Performance Standards and Compliance Monitoring

For the MNA component of the remedy to meet the performance requirements, VOC concentrations in groundwater must be reduced to aquifer cleanup standards in approximately 30 years or less and groundwater exceeding cleanup standards must not reach the compliance boundaries established for the central and eastern UAU and MAU. Specific trigger criteria have been developed to determine if natural attenuation is progressing as expected and will meet the cleanup objectives. These are described below.

Contingency Trigger Criteria for UAU

Sentinel wells will be located in the UAU upgradient of the UAU compliance boundary in an area bounded by Broadway Road to the north, approximately 1,000 feet south of Broadway Road to the south, approximately 1,000 feet east of Price Road to the East, and Dorsey Lane to the west. For the UAU, the contingency remedy will be triggered if either one of the following situations occurs:

(a) If verification sampling at the sentinel wells confirms that data collected during quarterly sampling exceed the aquifer cleanup standards, and if the average contaminant concentration collected from the next two consecutive sampling rounds from this well exceeds the aquifer cleanup standards, then the contingency remedy will be activated. The contingency remedy may be implemented sooner, if needed.

(b) EPA-approved flow and transport modeling will be conducted using data collected during each EPA 5-year review period. If the modeling evaluation indicates that the MNA remedy will not attain aquifer cleanup standards within a reasonable time frame of approximately 30 years from the start of remedial action, then the contingency remedy will be activated.

Contingency Trigger Criteria for MAU

Sentinel wells will be located approximately 1,000 feet upgradient of the MAU compliance boundary. For the MAU, the contingency remedy will be triggered if either one of the following situations occurs:

(a) If verification sampling of the sentinel wells confirms that data collected during quarterly sampling exceed the aquifer cleanup standards, and if the average contaminant concentration collected from the next two consecutive sampling rounds from this well exceeds the aquifer cleanup standards, then the contingency remedy will be activated. The contingency remedy may be implemented sooner, if needed.

(b) EPA-approved flow and transport modeling will be conducted using data collected during each EPA 5-year review period. If the modeling evaluation indicates that the MNA remedy will not attain aquifer cleanup standards within a reasonable time frame of approximately 30 years from the start of remedial action, then the contingency remedy will be activated.

Contingency Remedy – Additional Extraction and Treatment

If the MNA does not perform as expected and the trigger criteria described above are exceeded, the contingency remedy will be implemented. The contingency remedy will include groundwater extraction in the central and/or eastern UAU or the MAU of a target volume of contaminated groundwater, followed by groundwater treatment, and treated water discharge.

The location and magnitude of groundwater extraction for the target volume required will be determined on the basis of groundwater conditions at the time the trigger criteria are exceeded. The groundwater extraction of the target volume implemented as part of the contingency action must be sufficient to ensure that groundwater cleanup standards are not exceeded at the compliance boundary and that the time to meet aquifer cleanup standards is not exceeded. If appropriate, the monitored natural attenuation remedy may still be in use in portions of the central and/or eastern UAU and the MAU even as active extraction is occurring in other portions of these areas.

Groundwater treatment and treated water discharge under the contingency remedy would have the same components, performance standards and monitoring requirements as described below in Section 11.2 for the western area of contamination in the selected remedy. The location of any additional treatment plant(s) and the end use of the additional treated water will be determined during the remedial design phase of the contingency action.

11.2 Groundwater Treatment and Discharge Component

This section describes the treatment of the contaminated groundwater and discharge of the treated water. This includes the treatment of the western UAU area of contamination, as well as any target volume of the central and/or eastern UAU and MAU areas of contamination treated because of activation of the contingency remedy.

The groundwater extracted as part of any groundwater remedial action will be piped to a treatment system for VOC removal. It is expected that the VOCs will be removed from the groundwater by air stripping with offgas treatment using VGAC vessels. However, the LGAC or UV/Ox treatment processes may also be used if more cost-effective. A more detailed description of these three groundwater treatment processes is provided in Section 8 of this ROD and in the FS (EPA, 1997). The appropriate treatment process will be selected during remedial design when more is known about the anticipated influent flow rates and contaminant concentrations of the target volumes to be extracted.

The treated water will be discharged to either the City of Tempe storm drain system leading to Town Lake, the SRP Tempe Canal No. 6, or to the MAU aquifer through reinjection. EPA will determine the selected end-use option for the treated groundwater during remedial design and will consider the input provided by the community during the public comment period.

Performance Standards

The treatment plant discharge performance standards will vary with the different discharge options considered for the treated groundwater, as further defined in the ARARs section of this ROD (Section 12.0). The treatment plant(s) will be capable of meeting the effluent discharge standards. If discharge of the treated groundwater is to Town Lake, then aquatic and wildlife standards for a warm water fishery would be met. If discharge is to Tempe Canal or reinjection to the MAU, then the MCL or human health-based guidance level (HBGL) listed in Table 12 of the ARARs section (Section 12) would be met.

11.3 Additional Components

This section describes additional components of the selected remedy, including well abandonment, institutional controls, and groundwater monitoring.

Well Sealing or Abandonment

The selected remedy includes sealing or abandonment of Well SRP23E, 2.9N to eliminate this potential path of VOC contaminant migration from the UAU to the MAU. This well is located in an area of shallow contamination and represents a potential conduit for downward contaminant migration. The sealing or abandonment will be done in accordance with appropriate State of Arizona guidelines. In addition, other monitoring wells that will not be included in the long-term monitoring network will be abandoned, as appropriate, in accordance with State of Arizona guidelines.

Institutional Controls

Institutional controls will be established to protect the public from exposure to contaminated groundwater exceeding aquifer cleanup levels until aquifer cleanup goals are met. Institutional controls will include various Arizona well siting, permitting, and construction restrictions, and notices distributed by the ADWR, Arizona Department of Health Services, or EPA concerning risks from exposure to contaminated groundwater. Additional institutional controls to prevent interference with EPA's remedial efforts also may be established.

Groundwater Monitoring

Continued monitoring of groundwater will be performed to verify the effectiveness of the extraction and treatment and MNA remedies and to ensure that aquifer cleanup goals are met throughout the areas of VOC contamination. A long-term monitoring program will be designed and implemented during the RD/RA and will continue as long as contamination remains above cleanup standards. The monitoring program will assess performance of the groundwater containment system or systems, monitor the progress of natural attenuation in areas without active groundwater extraction, monitor to determine if the contingency remedy trigger criteria are exceeded, and monitor effluent chemical concentrations from the treatment system.

11.4 5-Year Review

This remedial action is expected to take more than 5 years to achieve aquifer cleanup levels. Accordingly, by policy, EPA will perform a review of the selected remedy no less than 5 years after completion of the construction for all remedial actions at the site. This review will ensure that the remedy is operating and functioning as designed, that institutional controls are in place and are protective, and that natural attenuation is progressing as expected. An additional purpose for the review is to evaluate whether the performance standards specified in this ROD remain protective of human health and the environment. EPA will continue the reviews until no hazardous substances, pollutants, or contaminants remain at IBW-South above levels that allow for unrestricted use and unlimited exposure to groundwater.

11.5 Conceptual Design

The conceptual design for the extraction and treatment components of the selected remedy is shown in Figure 11.

The extent of UAU contamination at the western area would be contained and restored using three extraction wells positioned approximately along the downgradient edge of the area contaminated above aquifer cleanup standards.

The well locations shown on Figure 11 were selected during the FS and are based on the extent of contamination using data through February 1995. The revised extent of contamination using data through April 1998 is also shown on Figure 11. The well locations and pipe routing were not revised to prepare the cost estimate because further modifications will be required based on the location of the highest contaminated area during remedial design.

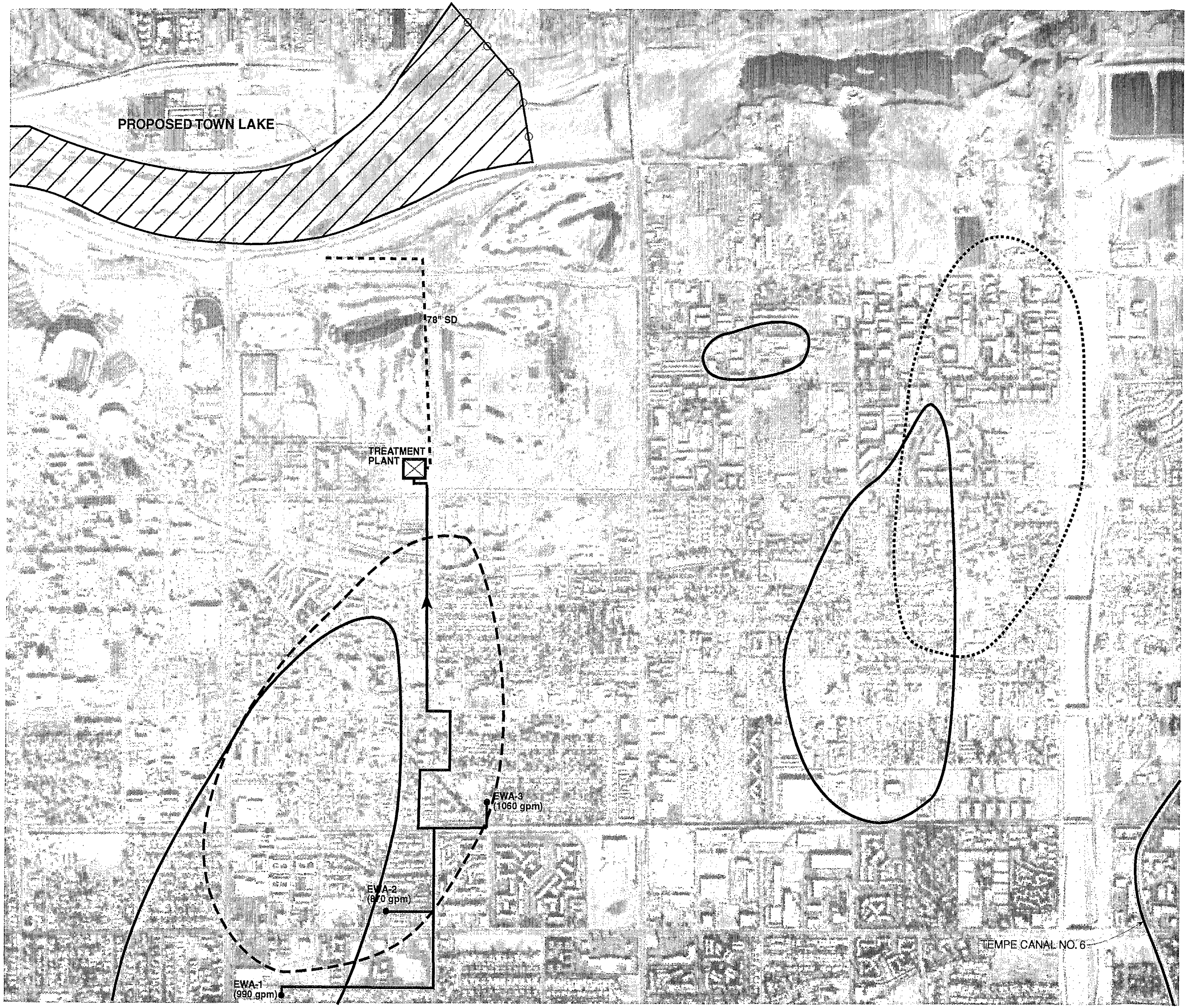
The extracted groundwater is piped to a centralized treatment system and the VOCs are removed from the groundwater by air stripping (or other treatment). VOC-contaminated offgas from air stripping is treated by using VGAC vessels. The treated water would then be delivered to the City of Tempe storm drain system leading to Town Lake, the SRP Tempe Canal No. 6, or reinjected to the MAU aquifer. The Proposed Plan stated that the exact end use for the treated groundwater will be determined after EPA considered all comments received on the Proposed Plan and performed remedial design work for the remedy.

Groundwater contamination in the MAU and those portions of the central and eastern areas of the UAU that are not contained by the extraction wells would be allowed to naturally attenuate. Additional monitoring wells and verification monitoring will be performed to verify the natural attenuation process.

The costs for the selected remedy were estimated assuming the following components and are discussed in Appendix A.

- Three extraction wells installed in the UAU
  - Total depth = 170 feet
  - Screened Interval = 46 to 126 feet bgs
  - Total flow rate = 2,940 gallons per minute (gpm)
  - Three telemetry systems (one per extraction well)
  - Three electrical hookups (one per extraction well)
- Treatment plant
  - One air stripping tower (height = 28 feet)
  - Two VGAC offgas treatment units (capacity of each = 9,830 standard cubic feet per minute [scfm])
- Number of samples
  - 106 bi-monthly VOC air samples
  - 53 bi-monthly VOC water samples
  - 14 annual general chemistry water samples.

  The number of samples also includes quality control samples at 10 percent frequency.
- Conveyance pipeline, between extraction wells and treatment plant, made of high-density polyethylene (HDPE) dual-cast (DC) pipe
  - 4,400 linear feet of 10-inch-diameter
  - 1,000 linear feet of 12-inch-diameter
  - 5,500 linear feet of 14-inch-diameter
- Distribution pipeline, between treatment plant and Town Lake, made of HDPE DC pipe
  - 50 linear feet of 16-inch-diameter (connection to COT storm drain)
- One distribution pump station (60 hp) located within the treatment plant boundary
- One outfall structure



LEGEND

- ESTIMATED EXTENT OF CONTAMINATION ABOVE MCL IN UAU (USING DATA THROUGH APRIL 1998)
- ESTIMATED EXTENT OF CONTAMINATION ABOVE MCL IN UAU (AS PRESENTED IN GROUNDWATER FS)
- ESTIMATED EXTENT OF CONTAMINATION ABOVE MCL IN UAU (USING DATA THROUGH APRIL 1998)
- CONVEYANCE PIPELINE TO TREATMENT PLANT
- DISTRIBUTION PIPELINE TO END USE
- POTENTIAL TREATMENT PLANT LOCATION (INCLUDES PUMP STATION)
- PROPOSED EXTENT OF TOWN LAKE
- EWA-1 EXTRACTION WELL
- RUBBER DAM

NOTE

THE COST ESTIMATE FOR THE SELECTED REMEDY WAS PREPARED ASSUMING TOWN LAKE IS THE DISCHARGE LOCATION. THE ACTUAL DISCHARGE LOCATION WILL BE DETERMINED DURING REMEDIAL DESIGN AND MAY BE GROUNDWATER REINJECTION TO THE MAU, THE SRP TEMPE CANAL NO. 6, OR TOWN LAKE.

ACTUAL PIPELINE ROUTING, EXTRACTION WELL LOCATIONS, AND TREATMENT PLANT LOCATIONS WILL BE DETERMINED DURING REMEDIAL DESIGN.

N

0 600 1200 FEET

FIGURE 11
CONCEPTUAL DESIGN FOR EXTRACTION AND TREATMENT OF SELECTED REMEDY
INDIAN BEND WASH-SOUTH GROUNDWATER OU ROD

2534_116 (9/23/98)

- Ten new monitoring wells (total depth 170 feet each)
- 176 VOC monitoring samples per year
- 53 general chemistry monitoring samples per year
- Annual sampling for general chemistry
  - 43 existing monitoring wells
  - 10 new monitoring wells
- Sampling for VOCs
  - Quarterly at 26 existing and 10 new monitoring wells
  - Semi-annually at 3 existing monitoring wells
  - Annually at 22 existing monitoring wells
  - Every other year at 8 existing monitoring wells

  The number of samples also includes quality control samples at 10 percent frequency.
- Sealing of screen interval at Well SRP23E,2.9N in the UAU.

Contingency Remedy

The costs for the contingency remedy were estimated assuming the components in the list below were added to the selected remedy. Details of the cost estimate for the contingency remedy are provided in Appendix A of this ROD.

- Three additional extraction wells installed in the UAU
  - Total depth = 170 feet
  - Screened Interval = 46 to 126 feet bgs
  - Total flow rate = 2,940 gpm
  - Three telemetry systems (one per extraction well)
  - Three electrical hookups (one per extraction well)
- Treatment plant
  - One additional air stripping tower (height = 28 feet)
  - Two additional VGAC offgas treatment units (capacity of each = 7,420 scfm)
- Number of additional samples
  - 106 bi-monthly VOC air samples
  - 53 bi-monthly VOC water samples
  - 14 annual general chemistry water samples.

  The number of samples also includes quality control samples at 10 percent frequency.

- Additional conveyance pipeline, between extraction wells in eastern contaminated area and conveyance pipeline included in selected remedy, made of HDPE DC pipe

- 8,200 linear feet of 12-inch-diameter
- 3,100 linear feet of 8-inch-diameter

11.6 Cost of the Selected Remedy and Contingency Remedy

The approach used to estimate costs for the alternatives in the FS and the selected and contingency remedies were presented in Section 8.0 and Appendix A of this ROD and in Appendix D of the FS.

Selected Remedy

Estimated costs of the selected remedy are:

- Capital Costs $ 6,170,000
- Annual O&M Costs $ 1,060,000
- Present Worth Cost (30 years) $22,460,000

These costs are based on the conceptual design for this remedy as described above.

Contingency Remedy

The estimated increase in cost if the contingency remedy is implemented is:

- Capital costs $2,410,000
- Annual O&M costs $10,000
- Present worth cost (30 years) $2,570,000

12.0 ARARs for Indian Bend Wash-South

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites must attain (or justify the waiver of) any federal or more stringent state environmental standards, criteria, or limitations that are determined to be ARARs. Applicable requirements are those cleanup standards, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. A requirement is applicable if the jurisdictional prerequisites of the environmental standard show a direct correspondence when objectively compared with the conditions at the site.

If a requirement is not legally applicable, the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well-suited to the conditions of the site. The criteria for determining relevance and appropriateness are listed in Title 40, Code of Federal Regulations (CFR), Section 300.400(g)(2) (40 CFR 300.400[g][2]). If no specific ARAR exists, then other guidelines or criteria "to be considered" (TBC) may be identified and used to ensure protection of human health and the environment.

ARARs are divided into three categories: chemical-specific, location-specific, and action-specific requirements. The chemical-specific ARARs are health- or risk-based concentration limits, numerical values, and methodologies for contaminant media. The chemical-specific ARARs for the IBW-South remedial actions define the concentration levels for contaminants in the groundwater that determine whether a problem exists at the site and the subsequent cleanup criteria. Chemical-specific ARARs also define the concentration levels required for satisfactory groundwater treatment and implementation of the end-use alternatives for the treated groundwater. Location-specific ARARs relate to the geographical or physical location of the site, and may limit what actions can be taken, given the specific geographic characteristics of the site. Action-specific ARARs are technology- or activity-based requirements triggered by the type of remedial activity being conducted. Examples are requirements that define acceptable treatment and disposal procedures for hazardous substances. A detailed discussion of the potential ARARs identified for the IBW-South site is provided in the IBW-South 1997 FS.

The ARARs for the IBW-South site have been identified in a sequential manner. First, the ARARs that impact remedial goals, independent of the remedial alternatives, were identified. These are the chemical- and location-specific regulations and objectives that govern the release and need for remediation of specific hazardous substances and present how the physical location of the site can determine where and how facilities can be constructed and operated. Next, the action-specific ARARs are identified for each alternative. These define the performance requirements of the system and may impact cost and implementability of the alternative. The State of Arizona identified proposed ARARs to EPA.

ARARs include only the substantive, not the administrative, requirements of a statute or regulation. The substantive portions of the regulation are those requirements that pertain directly to actions or conditions in the environment. Examples of substantive requirements include quantitative health- or risk-based restrictions upon exposure to types of hazardous substances. Administrative requirements are the mechanisms that facilitate implementation of the substantive requirements. Administrative requirements include issuance of permits, documentation, reporting, recordkeeping, and enforcement. Thus, in determining the extent to which onsite CERCLA response actions must comply with environmental laws, a distinction must be made between substantive requirements, which may be ARARs, and administrative requirements, which are not.

The ARARs provision in CERCLA applies only to onsite actions. "Onsite" is defined as the areal extent of contamination and areas in proximity to it necessary for the implementation of the remedy. According to CERCLA §121(e), a remedial response action that takes place entirely onsite is exempt from administrative portions of ARARs and may proceed without obtaining permits.

A requirement may not meet the definition of an ARAR as defined above, but may still be useful in determining whether to take action at a site and/or to what degree action is necessary. This can be particularly true when there are no ARARs for a site or a particular contaminant. Such requirements are TBC requirements. TBC materials are nonpromulgated advisories or guidance documents issued by federal or state government that are not legally binding, but that may provide useful information or recommended procedures for remedial action. Although TBCs do not have the status of ARARs, they may be considered together with ARARs to establish the required level of cleanup for protection of human health and the environment.

The federal and state statutes and requirements examined for EPA's ARARs analysis for IBW-South are identified in Appendix B to the IBW-South 1997 Feasibility Study.

12.1 Chemical-Specific ARARs

The chemical-specific ARARs that have been identified for IBW-South are those that: (1) affect groundwater remedial goals, and (2) determine to what degree groundwater should be treated prior to discharge. The major statutes and regulations that contribute to the list of potential chemical-specific ARARs are the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), Arizona Water Quality Standards for Navigable Waters, and Arizona Aquifer Protection Standards. The chemical-specific TBCs for the IBW-South site consider the ADHS HBGLs for Contaminants in Drinking Water. Chemical-specific ARARs for the more commonly detected organic compounds at IBW-South are summarized in Table 12. SDWA MCLs and nonzero MCLGs are the standards for aquifer cleanup, unless otherwise noted. Inorganic compounds are not considered COCs for IBW-South groundwater; however, they are included in Table 12 because inorganics will need to be considered in treating groundwater for discharge.

Chemical-Specific ARARs for Groundwater Remedial Goals

This section addresses the chemical-specific ARARs for aquifer remediation. The presence of contaminants above SDWA MCLs has degraded the beneficial uses of the groundwater at IBW-South; therefore, remedial actions will need to restore the contaminated groundwater and protect groundwater outside of the area of contamination.

The numerical values in the SDWA MCL standards are enforceable, health-based concentration limits formulated to protect water for human consumption for drinking, cooking, bathing, and other water-contact activities. MCLs are applicable to the quality of drinking water at the tap pursuant to the SDWA. Pursuant to 40 CFR Section 300.430(e)(2)(i)(B), MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) may be relevant and appropriate as in situ

TABLE 12
Chemical-Specific ARARs for the IBW-South Site (concentrations in µg/L)

	Aquifer Cleanup Standard	Discharge Limits for Tempe Canal and Re-injection	Discharge Limits for Town Lake	
Parameter	**(MCL or HBGL)**	**(MCL or HBGL)**	**(A&Wwa Acute)**	**(A&Wwa Chronic)**
Organics				
Benzene	5[b]	5[b]	2,700	180
Bromodichloromethane	100[b,c]	100[b,c]	-	-
Chloromethane	2.7[d]	2.7[d]	270,000	15,000
Chloroform	100[b,c]	100[b,c]	14,000	900
1,2-Dibromoethane	0.05[b]	0.05[b]	-	-
1,2-Dichloroethane	5[b]	5[b]	59,000	41,000
1,1-Dichloroethene	7[b,e]	7[b,e]	15,000	950
1,2-Dichloropropane	5[b]	5[b]	26,000	9,200
Methylene Chloride	5[b]	5[b]	97,000	5,500
1,1,2,2-Tetrachloroethane	0.18[d]	0.17[i]	4,700	3,200
Tetrachloroethene (PCE)	5[b]	5[b]	6,500	680
Trichloroethene (TCE)	5[b]	5[b]	20,000	1,300
Inorganics				
Antimony		6[b]	88	30
Arsenic		50[f]	360	190
Barium		2,000[b]	-	-
Beryllium		4[b]	65	5.3
Cadmium		5[b]	-[h]	-[h]
Chromium (total)		100[b]	-	-
Copper		1,300[b, g]	-[h]	-[g]
Cyanide		200[b]	41[i]	9.7[i]
Lead		15[b, g]	-[h]	-[g]
Mercury		2[b]	2.4	0.01
Nickel		100[f]	-[h]	-[g]
Selenium		50[b]	20	2.0
Thallium		2[b]	700	150
Zinc		2,100[d]	-[g]	-[g]

[a] Aquatic and Wildlife (warm water fishery).
[b] Maximum Contaminant Level (MCL).
[c] For total trihalomethanes.
[d] Human Health-Based Guidance Level (HBGL) for drinking water (December 1997 Update).
[e] Maximum Contaminant Level Goal is identical to the MCL.
[f] Arizona state MCL.
[g] Action level, not to be exceeded in more than 10 percent of samples.
[h] Concentrations vary depending on the hardness of the receiving water body.
[i] Arizona water quality standard for drinking water sources.

Note: The Arizona Aquifer Water Quality Standards for benzene, 1-2 dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, PCE, total trihalomethanes, TCE, antimony, barium, beryllium, cadmium, chromium, cyanide, selenium, and thallium are identical to the federal MCLs; identical to the state MCL for nickel; and 50 µg/L for lead.

aquifer cleanup standards for groundwater that is or may be used for drinking water. The MCLs and non-zero MCLGs are relevant and appropriate standards for the groundwater restoration at IBW-South because the beneficial uses of the groundwater aquifers include being potential drinking water supplies under ARS §49-224 and AAC §R18-11-407. The MCLs and non-zero MCLGs for the most common VOCs at IBW-South are presented in Table 12 under the aquifer cleanup standards heading. The state MCLs, found in AAC §R18-4-205 and 211 are listed in Table 12 only if they are more stringent than the federal MCLs or non-zero MCLGs.

For the main COCs, TCE and PCE, the MCL and the aquifer cleanup standard are 5 µg/L. The aquifer cleanup standards for the other most commonly detected VOCs, including PCE and TCE, are shown in Table 12.

The Arizona Aquifer Water Quality Standards (AAC §R18-11-406) are standards developed to protect groundwater by preventing discharges of pollutants that are above certain concentrations to aquifers, that endanger human health, or that impair the uses of the aquifer. In Arizona, all aquifers are identified as drinking water source aquifers unless specifically exempt (ARS §49-224). The Aquifer Water Quality Standards that are applied to aquifers classified as sources of drinking water are currently identical to the federal SDWA MCLs. The federal MCLs or the federal non-zero MCLGs for some hazardous substances are selected as ARARs because the state standards are not more stringent than the federal MCLs.

TBCs that have been evaluated for some substances at the IBW-South site include the ADEQ HBGLs which are health-based levels for drinking water. These levels, although set forth in Arizona regulations, are not "promulgated" in the sense of being legally enforceable and generally applicable. They are useful, however, for determining potential cleanup levels for groundwater at IBW-South for compounds that do not have federal or state MCLs.

EPA has not selected HBGLs as cleanup standards for any hazardous substance for which there is an MCL or non-zero MCLG because MCLs and MCLGs are health-based standards and are thus adequately protective. Moreover, the Arizona Aquifer Water Quality Standards are generally identical to the MCLs and they, rather than the HBGLs, are the state's promulgated aquifer standards. The HBGLs to be considered for the groundwater remedy pertain only to those hazardous substances for which no MCL or MCLG has been established: chloromethane, 1,1,2,2-tetrachloroethane, and zinc. These HBGLs are also included in Table 12.

The following chemicals have been detected more than three times at IBW-South but only at concentrations significantly less than the MCL (or HBGL for chemicals without an MCL): acetone, 2-butanone, carbon disulfide, cis-1,2,-dichloroethene; trans-1,2-dichloroethene, 1,1,1-trichloroethane, and vinyl chloride. Accordingly, EPA has not included these substances in Table 12. Additionally, ethyl benzene, toluene, styrene, and total xylenes have been detected above MCLs at wells installed as part of State Leaking Underground Storage Tank (LUST) investigations (e.g., MOBIL2-1). Although initially detected at concentrations higher than the corresponding MCL, none of these chemicals has been detected above the MCL since 1996. Therefore, EPA has not included these substances in Table 12.

This ROD does not address either the remediation approach or cleanup standards for methyl tertiary butyl ether (MTBE). Only recently has MTBE been detected at IBW-South at levels significantly above the Arizona HBGL of 35 µg/L and EPA's health advisory range of 20 to 40 µg/L for taste and odor. Given the recent detection of significant levels of MTBE, limited toxicity data available, and other factors, MTBE was not determined to be a chemical of concern in EPA's 1997 Risk Assessment. The elevated levels of MTBE are located in a small part of the central contaminated area, which is covered by a corrective action plan issued by the ADEQ Leaking Underground Storage Tank (UST) program. If it becomes apparent that ADEQ's UST efforts will not result in the cleanup of MTBE in the aquifer, EPA will evaluate the necessity and appropriateness of remedial action for MTBE. Additionally, if the contingency remedy is activated for the VOCs where MTBE is found, and if MTBE thus would be present in extracted groundwater, EPA would evaluate treatment systems and seek to treat the extracted groundwater to the appropriate discharge level considering the end use of the treated groundwater and other relevant circumstances.

Other chemicals have been detected but are not expected to be present in extracted groundwater for a variety of reasons, including infrequent detections or detections at very low concentrations. Such chemicals have not been identified as chemicals of potential concern (COPCs) or COCs because of their infrequent detection and low levels; thus, EPA need not establish aquifer cleanup standards for these chemicals and has not included them in Table 12.

ARARs Regulating Groundwater Discharge Concentrations

This section addresses chemical-specific ARARs for the onsite treatment of extracted groundwater.

Section 304 of the CWA requires EPA to publish water quality criteria for specific pollutants or their by-products. The Federal Clean Water Act, 33 U.S.C. § 1251, *et seq.*, and its implementing regulations, the National Pollutant Discharge Elimination System (NPDES), 40 CFR Parts 122-125, require direct discharges from CERCLA sites to surface waters to meet substantive Clean Water Act limitations. EPA develops two kinds of water quality criteria: one for the protection of human health and another for the protection of aquatic life. Federal water quality criteria are non-enforceable guidelines used by the states to set water quality standards for surface water. The states develop water quality standards to protect existing and attainable uses of the receiving water.

The limits for extracted groundwater quality will vary with the end use, which is to be finalized during Remedial Design. If discharge is to surface waters, state water quality standards will generally be ARARs; if discharge is to groundwaters, other standards are triggered. The possible end-use ARARs are discussed below.

Discharge to Tempe Canal No. 6

In Arizona, the narrative and numerical water quality standards promulgated pursuant to the Clean Water Act discussed above, found in ARS §49 - 222 and AAC §R18-11-108 and 109, are applicable to discharges to surface waters to protect the beneficial uses of the water. These standards vary with the designated beneficial use of the receiving water, pursuant to AAC R18-11-104. The beneficial uses may include domestic water source, full body contact, partial body contact, fish consumption, use by aquatic organisms and wildlife, agriculture irrigation, and agriculture livestock watering. If treated groundwater is discharged to SRP Tempe Canal No. 6, then it must meet the standards for the protection of domestic water sources because the water in the canal is used as a source of drinking water. The drinking water source numeric water quality standards are identical to the federal SDWA MCLs for the following substances: benzene, 1,2-dibromoethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, TCE, bromodichloromethane, and chloroform (AAC Title 18, Chapter 11, Section R18-11-109 and Appendix A). For 1,1,2,2-tetrachloroethane, the Arizona Standard is

0.17 µg/L. Because state limits are not more stringent, the federal MCLs will be applicable, unless otherwise indicated in Table 12. The MCLs and other standards are presented in Table 12. The water quality standards that the treated groundwater would have to meet prior to discharge to Tempe Canal No. 6 would typically be presented in the NPDES substantive requirements.

Arizona's antidegradation policy for navigable waters is applicable to the discharge of treated groundwater to navigable water (AAC §R18-11-107). This regulation states that where existing water quality in a navigable water does not meet applicable water quality standards, degradation of the water is not allowed. Where the existing water quality exceeds applicable standards, the existing quality will be maintained and protected. According to SRP personnel, Tempe Canal No. 6 is considered a navigable water; therefore, the antidegradation policy applies to discharges of treated groundwater to the canal.

Discharge to Town Lake

If treated groundwater is discharged to Town Lake, then the numerical water quality standards, both acute and chronic, for Aquatic and Wildlife (warm water fishery) (A&Ww) would be applicable to protect the beneficial uses of Town Lake. These beneficial uses include use of the surface-water body by animals, plants, or other organisms (excluding salmonids) for habitation, growth, or propagation. According to COT and ADEQ personnel, the beneficial uses of Town Lake do not include domestic water supply or swimming; therefore, the water quality standards for full or partial body contact and drinking water do not apply. These A&Ww standards are presented in Table 12. Although not an ARAR, NPDES requirements would apply to the offsite discharge of treated groundwater to Town Lake.

Reinjection

As discussed above, the Arizona Aquifer Water Quality Standards (AAC §R18-11-401 *et seq.*) are standards developed to protect human health and the uses of the aquifer by preventing discharges, including treated groundwater that is reinjected to groundwater above certain concentrations. These standards are currently identical to the SDWA MCLs and state MCLs; thus, federal MCLs (and more stringent state MCLs) are the relevant and appropriate ARARs for reinjection. If treated groundwater is reinjected into a contaminated aquifer, then the reinjection cannot cause additional degradation of the aquifer.

12.2 Location-Specific ARARs

Location-specific ARARs differ from chemical-specific or action-specific ARARs in that they are not closely related to the characteristics of the wastes at the site or to the specific remedial action being taken. Location-specific ARARs are concerned with the area in which the site is located. Actions may be required to preserve or protect aspects of the environment or cultural resources of the area that may be threatened by the existence of the site or by the remedial actions to be undertaken at the site. Location-specific ARARs for the IBW-South site are listed in Table 13.

Extraction of contaminated groundwater at the IBW-South site may occur within the SRP service area as part of the remedial action. If groundwater is extracted from within the SRP service area, substantive requirements will be obtained from SRP as necessary. In addition, if groundwater is extracted from within the SRP service area and used outside the service area (i.e., Town Lake), discussions with SRP will be conducted to consider such issues as water quality, water rights, water accounting, cost, liability, and operational concerns.

12.3 Action-Specific ARARs

Action-specific ARARs have been identified for the implementation of the remedial action. A description of the requirements associated with some of the significant ARARs and a discussion of the conditions under which the ARAR is applicable or relevant and appropriate is included below. The actions addressed include components of the extraction, treatment, and groundwater end-use options for the remedial action. Action-specific ARARs for the IBW-South site are presented in Table 13.

Hazardous Waste Management ARARs Under RCRA

The Resources Conservation and Recovery Act (RCRA), as amended, regulates the management, treatment, storage, and disposal of solid and hazardous wastes. The RCRA program is a delegable program: the states may manage the program in lieu of EPA if the state statutes and regulations are equivalent to or more stringent than the federal statutes and regulations. EPA authorized Arizona to run the RCRA hazardous waste program; therefore, the relevant provisions of the state statutes and regulations are treated as the federal requirements, in lieu of the federal statutes and regulations. Arizona requirements that exceed the scope of the federal requirements for these programs are treated as state requirements. Therefore, in some cases the applicable or relevant and appropriate RCRA requirement will be cited as state law and in other cases as federal law.

At the IBW-South site, the contaminated groundwater is not a listed RCRA hazardous waste because insufficient information exists at this time on the genesis of the groundwater contamination to determine whether the groundwater could be listed. The groundwater is not a characteristic hazardous waste because the contaminants in the groundwater are below the levels established for the characteristic of toxicity. Consequently, the RCRA requirements that are triggered by the hazardous nature of waste are not applicable to the untreated groundwater, but are relevant and appropriate. For these same reasons and because of EPA's exception for contaminated media (e.g., memorandum from Silvia K. Lowrance to Jeff Zelikson, January 24, 1989), the groundwater that has been treated to health-based standard (i.e., MCLs) would not be a RCRA hazardous waste, and the RCRA requirements would not be triggered. Some RCRA requirements are applicable or relevant and appropriate to excavated soils, spent carbon, or other wastes resulting from the remedial efforts (if such materials are characterized as hazardous waste) and are discussed below.

Storage and Handling

The substantive requirements for storage of hazardous waste of RCRA's regulations found in 40 CFR 264, as incorporated into or modified by AAC R18-8-264, are applicable to the storage of hazardous wastes generated onsite, such as contaminated carbon. These include requirements for container storage, management, and secondary containment; they are summarized in

TABLE 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Location	Requirement	Prerequisite(s)	Citation	Classification	Comments
Location – Specific ARARs					
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal.	40 Code of Federal Regulation (CFR) §264.18(b) (R18-8-264)	Relevant and Appropriate	Portions of the IBW-South site are located within a 100-year floodplain. A RCRA facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood.
Within floodplain	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	Executive Order 11988, Protection of Floodplains (40 CFR §6.302(b))	Applicable	Federal agencies are directed to ensure that planning programs and budget requests reflect consideration of floodplain management, including the restoration and preservation of such land as natural undeveloped floodplains. If newly constructed facilities are to be located in a floodplain, accepted floodproofing and other flood control measures shall be undertaken to achieve flood protection. Whenever practical, structures shall be elevated above the base flood level rather than filling land. As part of any federal plan or action, the potential for restoring and preserving floodplains so their natural beneficial values can be realized must be considered. Crossing of the IBW-South site with piping or location of wells in the 100-year floodplain would need to be designed to result in no impact to flood surface profiles.
Wetlands	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland as defined by Executive Order 11990 Section 7; actions involving construction or management of property.	Executive Order 11990, Protection of Wetlands (40 CFR Part 6, Appendix A). Clean Water Act Section 404; 40 CFR Parts 230.10	Potentially applicable	If wetlands are located within the area of proposed federal activities, the agency must conduct a Wetlands Assessment to identify wetlands and potential means of minimizing impacts. If there is no practical alternative to locating in or affecting the wetland, the Agency shall act to minimize potential harm to the wetland.
Aquifer of the State of Arizona	Unless specifically excluded, all aquifers of the State of Arizona are classified as potential drinking waters.	Aquifers of the State.	ARS of Section 49-224	Applicable	

TABLE 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Location	Requirement	Prerequisite(s)	Citation	Classification	Comments
Location – Specific ARARs					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Action to recover and preserve artifacts.	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data.	National Archaeological and Historical Preservation Act (16 USC Section 469); 36 CFR Part 65	Applicable	The IBW-South site is essentially completely developed. However, artifacts have been located in areas near IBW-South. The potential for impacts to artifacts will need to be considered and addressed during the design and implementation of the remedial action.
Place where artifacts, human remains, or funerary objects are discovered.	Requirements for archeological discovery and preservation.	Discovery of artifacts, human remains, or funerary objects.	ARS Section 41-841 through 41-844	Applicable	Archaeological objects have been discovered, according to the State of Arizona, near the site.
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks.	Property included in or eligible for the National Register of Historic Places.	National Historic Preservation Act Section 106 (16 USC 470 *et seq.*); 36 CFR Part 800, 40 CFR §6.301	Applicable	The DCE Circuits Building is included in the National Register of Historic Places (Inventory No. 151). The groundwater remedy will not impact this building.
Critical habitat upon which endangered species or threatened species depend	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior. Lists species of birds protected by four treaties between the U.S., Canada, Mexico, Japan, and Russia.	Potential presence of endangered species or threatened species or migratory birds.	Endangered Species Act of 1973 (16 USC 1531 *et seq.*); 50 CFR Part 200, 50 CFR Part 402, Migratory Bird Treaty Act (16 USC 703-712)	Potentially applicable	Applicable if critical habitats are discovered. No endangered species are currently known to exist on the IBW-South site. Migratory birds must be protected from poisoning at hazardous waste sites. The remedy will not expose migratory birds to hazardous materials.

TABLE 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Action	Requirements	Prerequisite(s)	Citation	Classification	Comments
Action-Specific ARARs					
Container storage (onsite)	Containers of hazardous waste must be: maintained in good condition; compatible with hazardous waste to be stored; and closed during storage (except to add or remove waste). Place containers on a sloped, sufficiently impervious crack-free base, and protect from contact with an accumulated liquid. Provide containment system with a minimum capacity of 24-hour, 25-year storm plus 10 percent of the volume of containers of free liquids or the volume of the largest container, whichever is greater. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system. At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.	RCRA hazardous waste held for a temporary period before treatment, disposal, or storage elsewhere, in a container (i.e., any portable device in which a material is stored, transported, disposed of, or handled).	Containers used for storage of hazardous waste onsite for more than 90 days must be: • Maintained in good condition (R18-8-264,171) • Compatible with other stored wastes (R18-8-264.172) • Closed during storage (R18-8-264.173) • Placed on a sloped, crack-free base with containment system in place capable of handling 10 percent of the free liquids stored (R18-8-264.175) • At closure, all hazardous wastes and residues from containment system must be removed (R18-8-264.178) • Secondary containment is required for storage of hazardous wastes over 90 days (R18-8-264.175). • Prior to transportation, containers should be packaged, labeled, marked, and placarded in accordance with RCRA and DOT requirements (R18-8-262.30 through R18-8-262.33).	Applicable to hazardous waste	These requirements are applicable or relevant and appropriate for untreated soil, groundwater, or treatment system residuals (e.g., contaminated carbon) that is a RCRA characteristic hazardous waste that might be containerized and stored onsite prior to treatment or final disposal. Currently, the untreated groundwater is not a RCRA hazardous waste, but these RCRA requirements are relevant and appropriate to it.

Table 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Action	Requirements	Prerequisite(s)	Citation	Classification	Comments
Action-Specific ARARs					
Storage of hazardous wastes subject to land disposal restrictions	Restrictions on storage, and requirements for marking and dating drums, tanks, etc.	Wastes subject to land disposal restrictions (LDR) that do not meet the treatment standards.	40 CFR Section 268.50	Applicable if any hazardous wastes are subject to LDRs	
Control of fugitive dust	Decrease emissions of fugitive dust from construction activities.	Construction activities that generate dust.	Maricopa County Rule 310	Applicable	Limits fugitive dust emissions during construction.
Processing, storing, using, or transporting of solvents or volatile compounds; activities that can emit odors or other gaseous air contaminants.	To adopt available means to effectively reduce the contribution to air pollution from evaporation, leakage, discharge or materials.	Construction or other activities that could emit odors or other gaseous contaminants.	Maricopa County Rule 320	Applicable	Where means are available to reduce air pollution from leaks, discharge, or evaporation, the use of such controls is mandatory.
Air Stripping	Control of air emissions of volatile organics and gaseous contaminants.	Emissions of VOCs or gaseous air contaminants.	Maricopa County Rules 200, 270, and 330	Applicable	Rules to control air emissions for the air stripping and vapor-phase activated carbon offgas treatment option for the remedial action.
	Control of air emissions from air strippers at Superfund sites.	Groundwater remedial actions.	OSWER Directive No. 9355.0-28	TBC	
Treatment (miscellaneous)	Standards for miscellaneous units require new units to satisfy environmental performance standards for protection of groundwater, surface water, and air quality, and by limiting surface and subsurface migration.	Treatment of hazardous wastes in units not regulated elsewhere under RCRA (e.g., air strippers).	40 CFR §264.601	Relevant and Appropriate	The substantive portions of these requirements may be relevant and appropriate to the construction, operation, maintenance, and closure of any miscellaneous treatment unit (a treatment unit that is not elsewhere regulated) constructed on the IBW-South site for treatment of groundwater.

TABLE 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Action	Requirements	Prerequisite(s)	Citation	Classification	Comments
Action-Specific ARARs					
Underground injection of wastes and treated groundwater	Underground Injection Control (UIC) program prohibits: • Injection activities that allow the movement of contaminants into underground sources of drinking water (USDW) and result in violation of MCLs or adversely affect health. • Construction of new Class IV wells and operation and maintenance of existing wells except wells used to reinject treated groundwater as part of a CERCLA action. Injection pressure may not exceed a maximum level designed to ensure that injection does not initiate new fractures or propagate existing ones and cause the movement of fluids into a USDW. Continued monitoring of injection pressure, flow rate, and volume is required. Reinjection with Class V wells shall not cause a violation of primary MCLs in the receiving aquifer. Continued monitoring of injection pressure, flow rate, and volume is required.	Underground injection of treated hazardous waste.	40 CFR §144.12 – 16 Substantive requirements of the Aquifer Protection Permit Program, including AAC §R18-9-108, -111, and –112..	Applicable or Relevant and Appropriate if reinjection is selected as discharge option.	Certain substantive requirements of the UIC program will not apply to onsite reinjection of treated groundwater, including those governing Class IV wells (wells used for the reinjection of extracted and treated groundwater) because both extracted and treated groundwater at the site are not considered RCRA hazardous wastes. Such requirements are relevant and appropriate if reinjection is selected as the end use for treated groundwater. Substantive requirements of the Arizona Aquifer Protection Permit Program, including recharge, poor quality groundwater withdrawal, and well installation requirements are applicable.

TABLE 13
Location-Specific and Action-Specific ARARs for the IBW-South Site

Action	Requirements	Prerequisite(s)	Citation	Classification	Comments
Action-Specific ARARs					
New well construction and withdrawal, treatment, and reinjection of extracted groundwater occurring as part of a CERCLA remedial action.	Specific requirements for wells, groundwater withdrawal, treatment, and reinjection.	CERCLA remedial action	ARS §45-454.01	Applicable	Exempts new well construction, withdrawal, treatment, and reinjection into the aquifer of groundwater that occur as part of a CERCLA remedial action from requirements of Arizona Groundwater Code, except that they must comply with the substantive requiremens of: • ARS 45-594 (well construction standards) • ARS 45-595 (well construction requirements) • ARS 45-596 (notice of intenton to drill well) • ARS 45-600 (filing of log by driller of well) In addition, this statute requires that uses of extracted groundwater be consistent with various articles of Chapter 2 of the Groundwater Code, which are discussed in the text.

Table 13. In addition, some requirements pertaining to the handling of hazardous wastes in R18-8-262.30 through R18-8-262.33 are applicable to any hazardous wastes generated onsite.

Treatment

The substantive requirements for miscellaneous RCRA units may be considered relevant and appropriate to air stripping towers and offgas treatment units managing or treating hazardous wastes even though the site and remedial efforts are not a treatment, storage, or disposal facility. These include the substantive requirements of 40 CFR 264.601, which regulate the design, operation, and maintenance of miscellaneous units.

Reinjection ARARs

If reinjection to the aquifer of extracted, treated groundwater is selected as the end use for the treated groundwater, certain additional action-specific ARARs will be implemented. (The chemical-specific ARARs are discussed above, under Reinjection.)

Federal regulations that govern underground injection programs are found in 40 CFR 144.12 and 144.13. According to these regulations, the injection of treated groundwater cannot allow movement of contaminants into underground sources of drinking water which may result in violations of MCLs or adversely affect health. Reinjection of treated groundwater into the same formation it was withdrawn from is allowed as part of a CERCLA action.

If treated groundwater is reinjected into an aquifer, substantive requirements concerning recharge, poor quality groundwater withdrawal, and well installation will be applicable (Arizona Aquifer Protection Permit program [AAC §R18-9-108, -111, and -112]).

Groundwater Remediation Action-Specific ARARs

Arizona's state Superfund program, known as the Water Quality Assurance Revolving Fund (WQARF), provides for cleanup of hazardous substances in groundwater (ARS § 49-281 *et seq.*). Section 49-282.06 of WQARF, as recently amended, requires groundwater remedial actions to ensure the protection of public health, welfare, and the environment; to manage and cleanup hazardous substances, to the extent practicable, so as to allow for the maximum beneficial uses of the waters of the state; and to be reasonable, necessary, cost-effective, and technically feasible. These criteria are very similar to criteria applicable to response actions under CERCLA and the NCP. Those authorities require that remediations be protective of human health and the environment, meet ARARs, and consider advancing numerous other factors, including long-term permanence, the reduction of toxicity, mobility or volume; implementability, and cost-effectiveness. In addition, the NCP requires that groundwater remedial actions generally attain federal MCLs and non-zero MGCLs, where relevant and appropriate; the NCP also requires remedial alternatives developed to take into account the expectation that the remedial action will return groundwater to beneficial uses wherever practicable within a reasonable time frame for the site circumstances.

The WQARF provision does not appear to be more stringent than those in the NCP and therefore its requirements are not ARARs. Nonetheless, any remedy EPA selects will meet the WQARF statutory criteria by meeting the NCP requirements.

A WQARF regulation, Section R18-7-109, addresses remedial action requirements. That regulation incorporates many of the requirements of WQARF Section 49-282.06 discussed above, and incorporates by reference provisions of state law establishing that all definable aquifers are drinking water aquifers unless they qualify for an exemption, and that establish water quality standards for discharges to aquifers. Section R18-7-109 is not more stringent than the requirements in the NCP and is therefore not an ARAR. However, the regulation requires remedies to be consistent with provisions of the Arizona Groundwater Code. Section 45-454.01 of the Arizona Groundwater Code, the substantive requirements of which would apply to the site, exempts from the Groundwater Code's requirements onsite construction of wells, and the withdrawal, reinjection, and treatment of groundwater occurring as part of and on the site of CERCLA remedial actions, with few exceptions. These exceptions include the substantive provisions of the following Arizona statutes, the substantive requirements of which are applicable to the installation of groundwater extraction or reinjection wells.

- ARS § 45-594 (well construction standards)
- ARS § 45-595 (well construction requirements)
- ARS § 45-596 (notice of intention to drill well)
- ARS § 45-600 (filing of log by driller of well)

In addition, ARS Section 45-454.01 requires that the uses of extracted groundwater at the site be consistent with the following articles of the Arizona Groundwater Code, Title 45, Chapter 2:

- Article 5 (grandfathered groundwater rights)
- Article 6 (groundwater rights)
- Article 7 (groundwater withdrawal permits)
- Article 8 (transportation of groundwater)
- Article 8.1 (withdrawal of groundwater for transportation for active management area)
- Article 9 (groundwater management)
- Article 10 (wells)

Air Emissions Requirements

The federal Clean Air Act (CAA), 40 CFR 7401, *et seq.*, implemented through its regulations at 40 CFR Parts 50-99, establish National Ambient Air Quality Standards (NAAQS). The Clean Air Act's NAAQS are not ARARs because they are not enforceable as applied to individual sources. Rather, the NAAQS are implemented through State Implementation Plans (SIPs).

Maricopa County has issued air pollution control rules, the substantive requirements of which apply to the air stripper that may be used to treat extracted groundwater at IBW-South, and are discussed below:

1. Maricopa County Rule 200, Permit Requirements—Specifies general requirements for major sources of air emissions. Major sources are defined as those sources capable of emitting 100 tons per year or more of any regulated air pollutant. Rule 200 exempts sources where total uncontrolled VOC air emission would be less than 3 pounds per day. The IBW-South groundwater treatment site is not expected to be a major source of VOC emissions; however, the pretreated airstream from the air stripping tower may require treatment or control of the offgas if found to exceed 3 pounds of VOC emissions per day.

2. Rule 270, Performance Tests—Establishes performance testing requirements for owners and operators of stationary sources to determine compliance with emission standards.

3. Rule 310, Open Fugitive Dust Emissions—This regulation will apply to construction of the treatment system. It imposes limits on the emission of particulate matter for any action, including construction activities, that can cause open fugitive dust emissions.

4. Rule 330, Volatile Organic Compounds—VOC emissions are limited to no more than 40 pounds per day. If this limitation is exceeded, emission of VOCs to the atmosphere must be reduced by specified methods including incineration, adsorption, or other processes not less effective than incineration or adsorption. Rule 330 includes efficiency requirements for the reduction process, and monitoring and testing requirements for VOC emissions.

Additional performance standards are addressed in Table 12.

13.0 Statutory Determinations

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with ARARs, are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy and the contingency remedy meet these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy and contingency remedy will protect human health and the environment by extracting and treating VOC-contaminated groundwater and MNA to ensure that the existing contamination does not migrate to groundwater users and that VOC contamination is reduced to groundwater cleanup standards in a reasonable time frame of approximately 30 years. Institutional controls will be enforced to protect the public from exposure to contaminated groundwater in the IBW-South area until cleanup standards are achieved.

The combination of groundwater extraction and natural attenuation will reduce the VOC concentrations in groundwater at the IBW-South site. Groundwater at the IBW-South site is currently used for industrial supply. Inactive municipal wells are also present. PCE and TCE were detected most frequently in the UAU and the MAU/LAU wells.

The selected remedy and contingency remedy will reduce the VOC contaminant levels to protective ARAR levels to restore groundwater to its beneficial use. The selected and contingency remedies will protect the groundwater resource by ensuring that VOC contamination in excess of aquifer cleanup standards does not migrate beyond compliance boundaries established in this ROD.

No short-term threats are associated with the selected remedy and contingency remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the selected and contingency remedies.

13.2 Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy and contingency remedy of groundwater extraction and treatment and MNA will comply with all ARARs identified for this action at the IBW-South site. The groundwater extraction, treatment, and MNA in selected areas will reduce the groundwater concentrations to chemical-specific ARARs within a reasonable time frame and ensure that additional migration of contaminated groundwater is limited. The ARARs for the selected remedy and contingency remedy are presented in detail in Section 12.0.

13.3 Cost-Effectiveness

The selected remedy and contingency remedy are cost-effective for mitigating the risks posed by VOC-contaminated groundwater at the IBW-South site. Section 300.430(f)(1)(ii)(D) of the NCP requires EPA to determine cost-effectiveness by evaluating the cost of an alternative relative to its overall effectiveness. Effectiveness is defined by three of the five balancing criteria: long-term effectiveness, short-term effectiveness, and reduction of toxicity, mobility, and volume of the contamination through treatment. The overall effectiveness is then compared to cost to ensure that the selected remedy is cost-effective.

The selected remedy will have long-term effectiveness because, by extraction and MNA, it will reduce contaminant levels to aquifer cleanup standards and maintain them. The selected remedy will have short-term effectiveness because there are minimal adverse impacts to the community, workers, and the environment during the implementation of the remedial action. The selected remedy will achieve a reduction in toxicity, mobility, and volume through treatment where treatment is warranted. Relative to the cost of the remedy, these results will provide a good value and will be cost-effective.

The estimated present worth cost of the selected remedy is $22,460,000. Although lower cost alternatives were evaluated (Alternatives 1 through 3), these alternatives are not effective and do not adequately meet EPA's threshold criteria of overall protection of human health and the environment and compliance with ARARs, nor do they ensure as much short-term effectiveness or reduction of toxicity, mobility, and volume of contamination through treatment. Alternatives 5 and 6 may somewhat speed the groundwater restoration, but these alternatives cost approximately $14 million and $26 million more than the selected remedy, respectively, and pose greater implementability difficulties than does Alternative 4. The costs represent increases of 64 percent and 115 percent, respectively. The selected remedy (Alternative 4) is the lowest cost remedy that is also effective and achieves EPA's remediation goals within a reasonable time frame. Therefore, the selected remedy is the most cost-effective remedy for remediation of VOC-contaminated groundwater at the IBW-South site.

The additional cost of the contingency remedy of extraction and treatment in MNA areas is estimated at $2,570,000. The contingency remedy will have the same effectiveness as the extraction component of the selected remedy, and is thus cost-effective.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy and the contingency remedy represent the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the IBW-South site. Of those alternatives that are protective of human health and the environment and comply with ARARs (Alternatives 4, 5, and 6), EPA has determined that the selected remedy and contingency remedy provide the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The selected remedy and contingency remedy treat the threats posed by the site, achieving significant reductions in VOC concentrations in groundwater. The selected remedy and contingency remedy satisfy the criteria for long-term effectiveness by reducing VOC contamination in groundwater through extraction and MNA and destroying the VOCs during regeneration of the offgas system carbon or other treatment residual. Groundwater containment will effectively reduce the mobility of the VOCs in groundwater; extraction, natural attenuation, and treatment will reduce the toxicity and volume of VOC-contaminated groundwater. The selected remedy and contingency remedy do not present short-term risks different from other alternatives that incorporate treatment. No special implementability issues set the selected and contingency remedies apart from the other alternatives evaluated.

13.5 Preference for Treatment as a Principal Element

The selected remedy includes extraction and treatment of the contaminated groundwater in the western UAU area of contamination (and potentially other areas if the contingency remedy is implemented) through air stripping and carbon adsorption, or an alternate treatment option to be selected during remedial design. In combination with the remedy selected in the Vadose Zone OU ROD, the selected remedy and contingency remedy address the principal threats posed by the IBW-South site through the use of treatment technologies. By using treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

13.6 Five-Year Review Requirements

This remedial action is expected to take more than 5 years to achieve aquifer cleanup levels to allow for unlimited use and unrestricted exposure. Accordingly, by policy, EPA will perform a review not less than 5 years after completion of the construction for all remedial actions at the site, and may continue such reviews until EPA determines that hazardous substances have been reduced to levels protective of human health and the environment.

13.7 Implementability

The selected remedy is considered to be administratively and technically implementable. The services and materials required to implement this remedy are readily available and use current technologies.

13.8 Cost

The selected remedy is not the least costly of the alternatives considered, but it has significant advantages over less costly alternatives. In particular, unlike those alternatives that are less expensive, the selected remedy will result in cleanup levels being met within a reasonable time frame of approximately 30 years through active extracting and treating of groundwater and through MNA processes.

13.9 State Acceptance

The State of Arizona concurs with the selected remedy for IBW-South.

13.10 Community Acceptance

In general, comments on the Proposed Plan for IBW-South have indicated that the community supports the selected remedy for VOCs in groundwater.

Comments from some PRPs opposed EPA's preferred alternative for groundwater because they felt that MNA could be implemented without any groundwater extraction and treatment. In response to these concerns, EPA performed additional groundwater modeling but still finds that ARARs cannot be achieved within a reasonable time frame without active treatment in the western contaminated area. Extraction and treatment are therefore required, and the specific target volume of groundwater to be extracted will be determined during remedial design.

The community has expressed concern about the SRP Tempe Canal No. 6 as an end use. The community and some government agencies generally support Alternative 4 more than Alternatives 5 and 6 because it is more cost-effective and it extracts a smaller volume of groundwater.

Appendix A
Cost Evaluation

APPENDIX A

Cost Evaluation

A.1 Introduction

The purpose of this appendix is to document the estimated capital, annual operation and maintenance (O&M), and present worth (PW) costs associated with the selected remedy and contingency remedy for the Indian Bend Wash- South Superfund Site. These cost estimates are order-of-magnitude estimates and are expected to be accurate within +50 to –30 percent. The summary of the costs for the selected and contingency remedy is presented in Table A-1.

TABLE A-1
Costs for the Selected Remedy and the Contingency Remedy

Cost	Selected Remedy	Contingency Remedy
Capital	6,170,000	8,580,000
Annual O&M	1,060,000	1,070,000
30-Year Present Worth	22,460,000	25,030,000
5-Year Present Worth	10,760,000	13,210,000

The components for each remedy consist of containment, treatment, end use, and monitoring. The selected remedy consists of partial containment with three new UAU extraction wells and a total flow of 2,940 gallons per minute (gpm). The contingency remedy consists of partial containment with three additional new UAU extraction wells, as well as those used in the selected remedy, and a total flow of 4,440 gpm. Appendix D of the FS contains all the detailed information regarding the cost estimating procedures and assumptions. Table A-2 in this Appendix shows the detailed parts for the components for each remedy.

For cost comparison, a PW cost was calculated. The PW is the present value of the remedy at some defined period in the future. Because the length of time to achieve remediation of groundwater is undefined, the PW is calculated for a 5-year and a 30-year time period, both at an interest rate of 5 percent. The analysis of each remedy's power requirements and costs are provided in Attachment A-1. Attachment A-2 summarizes the capital and O&M costs for the treatment component of each remedy. The detailed capital and O&M costs for each remedy are presented in Attachment A-3.

Table A-2

Component Details for the Selected Remedy and Contingency Remedy

Alternative / Flow (gpm) / Components	Selected Remedy	Contingency Remedy
Flow (gpm)	2,940	4,440
Containment		
Number of UAU Extraction Wells	3	6
Number of MAU Extraction Wells	0	0
Number of Existing COT Municipal Wells	0	0
Number of Additional Monitoring Wells	10	10
Number of Telemetry Systems for each Extraction & Reinjection Well	3	6
Number of Site Electricity Setups for each Extraction Well	3	6
Treatment		
Treatment Plant		
Number of Air Stripping Towers	1	2
Number of VGAC Units	2	4
Linear Feet of Conveyance Pipeline:		
6" Diameter	0	0
8" Diameter	0	0
10" Diameter	4,400	7,400
12" Diameter	1,000	9,500
14" Diameter	5,500	5,500
16" Diameter	0	0
18" Diameter	0	0
20" Diameter	0	0
24" Diameter	0	0
28" Diameter	0	0
30" Diameter	0	0
End Use		
Linear Feet of Distribution Pipeline:		
6" Diameter	0	0
8" Diameter	0	0
10" Diameter	0	0
12" Diameter	0	0
14" Diameter	0	0
16" Diameter	50	50
18" Diameter	0	0
20" Diameter	0	0
24" Diameter	0	0
28" Diameter	0	0
30" Diameter	0	0
Distribution Pump Station (HP)	60	60
Number of Outfall Structures	1	1
Number of UAU Reinjection Wells	0	0
Number of MAU Reinjection Wells	0	0
Monitoring		
Monitoring Samples per Year	252	252

Attachment A-1

Pump Station and Power Cost Calculations

Parameter	Power Cost ($/kWh)	Pump/Motor Efficiency	Treatment Plant Residual Head (ft)	End Use Residual Head (ft)	Elevation Head (ft)
Assumed Value	0.09	1	30	10	20

Selected Remedy
End Use—Town Lake

Conveyance Pipeline and Pumping

Extraction Well			Pipeline		Extraction Well Pump		
Extraction Well	Pumping Rate (gpm)	Static Lift (ft)	Length (ft)	Friction Loss (ft)	TDH (ft)	Calculated HP	Installed HP
EWA-1	990	75	9,600	86	211	76	80
EWA-2	870	75	6,600	59	184	58	60
EWA-3	1,080	75	5,200	47	172	67	75
Total Flow	2,940						

Distribution Pipeline and Pumping

	Pumping Rate (gpm)	Static Lift (ft)	Length (ft)	Friction Loss (ft)	TDH (ft)	Calculated HP	Installed HP
	2,940	0	50	0	50	54	60
					Total HP Required =	254	
					Annual kWh =	1,660,469	
					Annual Power Cost =	149,442	

Contingency Remedy
End Use—Town Lake

Conveyance Pipeline and Pumping

Extraction Well			Pipeline		Extraction Well Pump		
Extraction Well	Pumping Rate (gpm)	Static Lift (ft)	Length (ft)	Friction Loss (ft)	TDH (ft)	Calculated HP	Installed HP
EWA-1	990	75	9,600	86	211	76	80
EWA-2	870	75	6,600	59	184	58	60
EWA-3	1,080	75	5,200	47	172	67	75
EWA-4a	500	75	9,300	84	209	38	80
EWA-5a	500	75	9,700	87	212	38	60
EWA-6a	500	75	9,700	87	212	38	75
Total Flow	4,440						

Distribution Pipeline and Pumping

	Pumping Rate (gpm)	Static Lift (ft)	Length (ft)	Friction Loss (ft)	TDH (ft)	Calculated HP	Installed HP
	4,440	0	50	0	50	81	60
					Total HP Required =	281	
					Annual kWh =	1,839,064	
					Annual Power Cost =	165,516	

Attachment A-2

Summary of Treatment Costs

Alternative	Treatment Plant	Flow (gpm)	Flow-weighted Concentrations TCE (µg/L)	Flow-weighted Concentrations PCE (µg/L)	Capital Cost ($)	Annual O&M ($)
Selected Remedy	1	2,940	17	0	1,089,606	773,737
Contingency Remedy	1	4,440	15	0	1,279,536	774,951

Attachment A-3
Estimated Capital and O&M Costs for the Selected Remedy and Contingency Remedy

Assumptions	
1. Conveyance Pipe Cost	5 per diam-in/LF
2. Distribution Pipe Cost	5 per diam-in/LF
3. Pipeline Appurtenances	15% of pipe capital cost subtotal
4. Expected life of	
Pipeline	40 years
Pumps	15 years
Wells	30 years
Treatment Plants	30 years
Telemetry	30 years
Site Electric	30 years
Outfall Structure	40 years
5. O&M Costs	
Extraction Wells	1% of capital
Pipeline & Appurt.	0.5% of capital
Distribution Pumps	5% of capital
Reinjection Wells	2% of capital
Outfall Structure	3% of capital
Telemetry	2% of capital
Site Electrical	2% of capital
6. Pump Station Costs	1,200 per motor HP
7. Lump Sums for following capital costs:	
Telemetry for Ex. & Reinj. Wells	20,000 per well
Site Electric. for Ex. Wells	30,000 per well
Discharge Structure	50,000 each
MAU Reinjection Wells	210,000 each
UAU Extraction Wells	76,000 each
MAU Extraction Wells	170,000 each
Additional UAU Monitoring Wells	76,000 each
Cement liner for SRP23E, 2.9N	150,000 each
8. VOC Analytical Costs	300 per sample
9. Physical Properties Analytical Costs	135 per sample
10. QA/QC Frequency	10% of total number of samples
11. Construction Allowance	12%
12. Bid Contingency	20%
13. Scope Contingency	20% Extraction, Reinjection, Conveyance
14. Legal Fees, Permitting Fees, etc.	2%
15. Services during construction	6%
16. Engineering Design	15%
17. Extraction and reinjection well costs include drilling, development, pump, and motor costs.	

Attachment A-3
Estimated Capital and O&M Costs for the Selected Remedy and Contingency Remedy

Alternative	**Selected Remedy**
End Use	**Discharge to Town Lake**
Containment Scenario	**Partial**
Number of Treatment Plants	**One**

Facilities	Estimated Quantity	Unit	Unit Price ($)	Extended Capital Cost ($)	O&M Cost ($)
UAU Extraction Wells	3	Each	$76,000	228,000	2,280
MAU Extraction Wells	0	Each	$170,000	0	0
Additonal UAU Monitoring Wells	10	Each	$76,000	760,000	7,600
Cement Liner for SRP23E, 2.9 N	1		$150,000	150,000	0
Treatment Plant 1		LS		1,089,606	773,737
No. Towers	1				
No. VGAC Units	2				
Treatment Plant 2	NA	LS			
Conveyance Pipeline (dia-in)					
6	0	LF	30	0	0
8	0	LF	40	0	0
10	4,400	LF	50	220,000	1,100
12	1,000	LF	60	60,000	300
14	5,500	LF	70	385,000	1,925
16	0	LF	80	0	0
18	0	LF	90	0	0
20	0	LF	100	0	0
24	0	LF	120	0	0
28	0	LF	140	0	0
30	0	LF	150	0	0
Subtotal	10,900			665,000	3,325
Appurtenances		LS		99,750	499
Distribution Pipeline					
6	0	LF	30	0	0
8	0	LF	40	0	0
10	0	LF	50	0	0
12	0	LF	60	0	0
14	0	LF	70	0	0
16	50	LF	80	4,000	20
18	0	LF	90	0	0
20	0	LF	100	0	0
24	0	LF	120	0	0
28	0	LF	140	0	0
30	0	LF	150	0	0
Subtota	50			4,000	20
Appurtenances		LS		600	3
Power					149,442
Distribution Pump Station (TP 1)	60	HP	1200	72,000	3,600
Distribution Pump Station (TP 2)	0	HP	1200	0	0
Telemetry for Ex. & Reinj. Wells	3	Each	20,000	60,000	1,200
Site Electric. for Ex. Wells	3	Each	30,000	90,000	1,800
Outfall Structure	1	Each	50,000	50,000	1,500
MAU Reinjection Wells	0	Each	210,000	0	0
Monitoring	194	VOC samples per year	300		58,200
	58	Property samples per year	135		7,830
Annual Reporting/Data Evaluation					50,000
Subtotal Capital Cost				3,268,956	
Construction Allowance				392,275	
Bid Contingency				653,791	
Scope Contingency				653,791	
Total Construction Cost				4,968,813	
Legal Fees, Permitting Fees, etc.				99,376	
Services During Construction				298,129	
Total Implementation Cost				5,366,318	
Engineering Design Costs				804,948	
Alternative Total Cost				$6,170,000	$1,060,000

Attachment A-3

Estimated Capital and O&M Costs for the Selected Remedy and Contingency Remedy

Alternative	**Contingency Remedy**
End Use	**Discharge to Town Lake**
Containment Scenario	**Partial**
Number of Treatment Plants	**One**

Facilities	Estimated Quantity	Unit	Unit Price ($)	Extended Capital Cost ($)	O&M Cost ($)
UAU Extraction Wells	6	Each	$76,000	456,000	4,560
MAU Extraction Wells	0	Each	$170,000	0	0
Additonal UAU Monitoring Wells	10	Each	$76,000	760,000	7,600
Cement Liner for SRP23E, 2.9 N	1		$150,000	150,000	0
Treatment Plant 1		LS		1,279,536	774,951
No. Towers	2				
No. VGAC Units	4				
Treatment Plant 2	NA	LS			
Conveyance Pipeline (dia-in)					
6	0	LF	30	0	0
8	3,100	LF	40	124,000	620
10	4,400	LF	50	220,000	1,100
12	9,200	LF	60	552,000	2,760
14	5,500	LF	70	385,000	1,925
16	0	LF	80	0	0
18	0	LF	90	0	0
20	0	LF	100	0	0
24	0	LF	120	0	0
28	0	LF	140	0	0
30	0	LF	150	0	0
Subtotal	22,200			1,281,000	6,405
Appurtenances		LS		192,150	961
Distribution Pipeline					
6	0	LF	30	0	0
8	0	LF	40	0	0
10	0	LF	50	0	0
12	0	LF	60	0	0
14	0	LF	70	0	0
16	50	LF	80	4,000	20
18	0	LF	90	0	0
20	0	LF	100	0	0
24	0	LF	120	0	0
28	0	LF	140	0	0
30	0	LF	150	0	0
Subtota	50			4,000	20
Appurtenances		LS		600	3
Power					149,442
Distribution Pump Station (TP 1)	60	HP	1200	72,000	3,600
Distribution Pump Station (TP 2)	0	HP	1200	0	0
Telemetry for Ex. & Reinj. Wells	6	Each	20,000	120,000	2,400
Site Electric. for Ex. Wells	6	Each	30,000	180,000	3,600
Outfall Structure	1	Each	50,000	50,000	1,500
MAU Reinjection Wells	0	Each	210,000	0	0
Monitoring	194	VOC samples per year	300		58,200
	58	Property samples per year	135		7,830
Annual Reporting/Data Evaluation					50,000
Subtotal Capital Cost				4,545,286	
Construction Allowance				545,434	
Bid Contingency				909,057	
Scope Contingency				909,057	
Total Construction Cost				6,908,835	
Legal Fees, Permitting Fees, etc.				138,177	
Services During Construction				414,530	
Total Implementation Cost				7,461,541	
Engineering Design Costs				1,119,231	
Alternative Total Cost				$8,580,000	$1,070,000

III. Responsiveness Summary

III. Responsiveness Summary

This Responsiveness Summary for the IBW-South Record of Decision for VOCs in groundwater presents significant comments that were received from the public, including the potentially responsible parties, concerning the selected remedy, the alternatives evaluated, and the 1997 Remedial Investigation and Feasibility Study. These comments were received during the public comment period, in accordance with Section 117 of CERCLA, 42 U.S.C. Section 117. This Responsiveness Summary includes EPA's responses to those significant comments.

The public comment period began on September 15, 1997, at which time the Proposed Plan was mailed to concerned citizens and other members of the community. The Proposed Plan noted the location and availability of the Administrative Record and the date, time, and location of the public meeting. The availability of the Proposed Plan and the Administrative Record and the time and place of the public meeting were also advertised in the Arizona Republic on September 15, 1997. The public meeting was held on September 24, 1997, at 7:00 pm at Gilliland Middle School in Tempe, Arizona. The meeting consisted of a formal presentation by EPA, followed by a comments and a question and answer period. The meeting was transcribed by a court reporter. EPA responded to comments at the public meeting; personnel of ADEQ and the City of Tempe also responded to some questions. In response to requests from community members, EPA extended the public comment period, which then formally closed on November 28, 1997.

EPA received written comments during the public comment period. These written comments and EPA's responses are presented in the following section. A transcript of the oral comments presented at the public meeting and EPA's responses follows the written comments.

The written comments that are summarized in this Responsiveness Summary were submitted by the following parties and appear in the order shown below within this document. Page numbers have been provided for ease in locating particular commentors and EPA's response to their comments.

Commentor	Page Numbers in This Document
Arizona Department of Environmental Quality by Maria M. Fant, Project Manager, Federal Projects Unit	1 to 3
Arizona Department of Water Resources by Mason R. Bolitho, Manager, Water Quality Section	4
Arizona Public Service Company by James M. Oliver, R.G., for Brown and Caldwell	5 to 16
City of Tempe by Bill Coughlin and Eric S. Kamienski	17
City of Tempe by Gary Brown, City Manager	18
City of Tempe by Karen S. Gaylord, Assistant City Attorney	19-20

Commentor	Page Numbers in This Document
Dava/Lakeshore Neighborhood Association by Kathyanne M. Pera	21 to 22
IMC Magnetics Corporation by C. R. Jenkins, President	23 to 30
IMC Magnetics Corporation by Timothy S. Hudson for Dames & Moore	31 to 61
Las Estadas Homeowners Association by Steve Bauer, President	62
Prestige Cleaners, Inc, & Arizona Jacobson Co. by Bruce C. Travers, R.G., for EMCON	63 to 69
Salt River Project by Kevin G. Wanttaja, Manager, Environmental Compliance	70
Salt River Project by Richard M. Hayslip for Environmental, Land & Risk Management	71 to 72
Unitog Rental Services, Inc. by Houmao Liu, Ph.D, and Robert J. Sterrett, Ph.D., for Hydrologic Consultants, Inc.	73
Unitog Rental Services, Inc. by Paul D. Kuhlmeier, Ph.D.	74 to 95
Warner Ranch Landing II Association by Mitch Hamlin, Vice President	96
Warner Ranch Phase II Association by Jerry Mosteller, President	97 to 98

Comments from Arizona Department of Environmental Quality

Dated 2/9/1998 by Maria M. Fant, Project Manager, Federal Projects Unit

No.	Comment	Response
1.01	ADEQ is concerned that Alternative 4, the Preferred Remedy, as currently described in the Proposed Plan, may not be appropriate for all the three plumes. For the Central and Eastern plumes, the proposed remedy fails to contain the migration of the contaminants. It may not be technically feasible or cost effective to assume that the entire volume of water contaminated by chlorinated volatile organic compounds (VOCs) can be remediated to Maximum Contaminant Levels (MCLs). While source control pumping has been discussed in general with the EPA as a possible remedial alternative, the capture areas presented in this alternative are larger than ADEQ expected, particularly in the Central and Eastern plume areas. ADEQ is doubtful whether the modeling and the assumptions in the FS can support the calculated partial containment proposed by EPA.	EPA has, based on more recent modeling, revised its remedy to allow for monitored natural attenuation (MNA) of the central and eastern plumes. EPA is confident that MNA will remediate VOCs in these contaminated areas to MCLs. EPA has designed a contingency remedy in the event that such is not the case. Although these contaminated areas may migrate somewhat, this remedy is protective of human health and the environment; EPA has conducted additional flow and transport modeling, using more current groundwater data, and determined that MCLs will be met in the central and eastern contaminated areas with limited migration and within a reasonable time frame of approximately 30 years. The MNA, combined with extraction and treatment, establish a cost-effective and feasible remedy to reduce contamination to MCLs.
1.02	ADEQ requests that EPA undertake another evaluation of the remedy and perform remodeling to include more recent groundwater data. ADEQ would like for EPA to reconsider the size of the partial containment areas, and the use of the monitored natural attenuation component of this remedy, particularly with regard to the Central and Eastern plumes, where contaminant concentrations are relatively low, and appear to be declining.	As indicated in the response to Arizona Department of Environmental Quality-Ms. Fant's Comment No. 1.01, EPA has done as ADEQ has requested.
2.01	Due to the inconclusive nature of the RI and the lack of definition of the source areas and other contributors, the conclusions in this report need to be supported with additional documentation, including the model assumptions and data sets used in the modeling and risk assessment.	EPA has performed additional modeling since the release of the FS. This additional modeling, which evaluated data collected since the FS cutoff date of July 1994, along with documentation of model assumptions and input parameters, was presented according to the American Society for Testing and Materials (ASTM) guidelines for model documentation in the Technical Memorandum re Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models, dated August 12,1998. This technical memorandum was mailed to ADEQ and groundwater stakeholders and is part of the Administrative Record for this site. In addition, data from this technical memorandum were presented to ADEQ as well as the groundwater stakeholders in meetings in Phoenix in June and July 1998. The modeling supports the RI's conclusion and EPA's selected remedy. EPA believes the source areas are adequately defined.
2.02	If the outcome of additional modeling using current data varies significantly from the previous modeling work, EPA should consider the possibility of implementing individual groundwater treatment systems at each of the plume areas (Eastern, Central, and Western Plumes). The RPs could be responsible for building and operating their own systems, thereby simplifying allocation. The Monitored Natural Attenuation portion of the plan could be implemented by EPA and the costs could be split between the RPs and the orphan share. It is possible that implementing three smaller systems rather than one large system could reduce costs associated with the remedy. The City of Tempe (COT) should be consulted regarding end use of the treated water if these options are explored.	EPA evaluated separate treatment plants in the FS and determined that one central treatment plant was the most cost-effective based on the data evaluated. However, the location and specifications of the treatment plant are to be determined during the remedial design when the volume and flow rates of the groundwater to be extracted and treated are known. Although the number and locations of treatment plants will be finalized during the remedial design phase, a multiple treatment plant scenario evaluated during the screening process of the FS was not cost-effective. EPA welcomes ADEQ's input on enforcement-related issues such as allocation. EPA will not be responding to enforcement issues in the remedy selection document. EPA will continue to work with the City of Tempe or groundwater end use issues.

Comments from Arizona Department of Environmental Quality

Dated 2/9/1998 by Maria M. Fant, Project Manager, Federal Projects Unit

No.	Comment	Response
2.03	EPA did not identify all of the RPs prior to issuance of the FS. Failure to promptly and defensibly identify RPs may lead to the expenditure of additional time and resources by EPA to finalize the FS and the Groundwater Remedy Record of Decision (ROD).	EPA's procedure for groundwater PRP identification was not out of the ordinary and was consistent with legal requirements. The timing of EPA's general notice to PRPs, in EPA's opinion, was prompt and defensible, and did not cause the results ADEQ mentions. Most of the groundwater PRPs had received general notices several years ago. Moreover, EPA ensured that the groundwater PRPs received time even beyond the already extended public comment period to review and comment upon the RI/FS and Proposed Plan. EPA incorporated some of the PRP recommendations in the remedy and has responded to their comments.
2.04	Comments re: Executive Summary, Contaminant Characteristics, Contaminants of Concern of the FS: In this section, the contaminants Trichloroethane (TCA), 1,1-Dichloroethene (1,1-DCE) and 1,2-Dichloroethene (1,2-DCE) should be added to the narrative to correlate with the information in Section 2.2.1.	TCA, 1,1-DCE, and 1,2-DCE were detected more than three times at IBW-South but only at concentrations significantly less than the MCLs or HBGLs. Accordingly, EPA did not identify these compounds as contaminants of concern at IBW-South.
3.01	Comments re: Section 4.1.2.2 Data Sources of the FS: In the FS, the partial volume remediation calculation uses the highest historical analytical results in SIBW but the risk assessment calculation uses data ranging from 1/94 to 2/96. The highest concentration of historical analytical data was collected in the early stages (1988-1993) of the RI in SIBW. This could indicate that the data used for the partial volume calculation is more conservative than the data used for the risk assessment. Explanation is provided to justify the selection of the data sets in each calculation but does not discuss the relationship of the risk assessment and the partial volume calculation to each other. Without this explanation, it appears that data sets may not have been selected consistently.	It was administratively necessary to have a cutoff date in order to complete review and analysis and the preparation of the FS. EPA considered the data through February 1996 in establishing the partial target volumes in the FS, but did not revise the volumes according to the 1996 data for these administrative reasons, and because the Proposed Plan provided that the partial target volumes would need to be further refined during the remedial design. Modeling of updated data (through October 1997) has been performed and distributed to the commentors and entered into the Administrative Record. That more recent data did not alter conclusions reached in the RI/FS, but did add support for the adoption of MNA as an expanded part of the remedy for the central and eastern UAU contaminated areas. The risk assessment evaluated data as a snapshot in time. See responses to Prestige Cleaners comment 3.1, IMC Magnetics comment 1-01.1, and Unitog Rental Services comment 11-0.
3.02	Comments re: Section 4.1.5 Identification of Contaminants of Concern, Page 4-17 of the FS: Benzene is present in the groundwater and soils at the Palm Harbor Home facility located immediately north of the IMC Magnetics site. If a partial volume remediation is performed at IMC, the pumping will pull in what remains of the gasoline release in the groundwater under Palm Harbor Homes. This information should be included in the risk assessment or the RI, since benzene is a known carcinogen.	Benzene, as well as other compounds related to gasoline or leaking underground storage tanks releases, has been detected at IBW-South. EPA did evaluate benzene in the risk assessment and, because benzene was detected sporadically and was not persistent throughout the contaminant plume, it was not considered to be a contaminant of concern. Although benzene was initially detected above MCLs, it has not been detected above MCLs since 1996. Based on evaluation of more recent data, it is not necessary to extract and treat groundwater from the central UAU unless the contingency remedy is triggered. ADEQ is currently overseeing the LUST investigation at Palm Harbor Homes regarding benzene and other related LUST contaminants.

No.	Comment	Response
3.03	Comments re: Section 8.3.2.1 The Process of Natural Attenuation, Page 8-11 of the FS: ADEQ is concerned that 1,1-DCE is not included in the risk calculations, but is a compound present in measurable quantities in SIBW. The reason given for exclusion is that the natural attenuation data set is incomplete. The text states that eight of the analytes used to assess natural attenuation were not analyzed during the SIBW RI. The rationale presented in this section is questionable, particularly due to the fact that extrapolation using incomplete historical data has occurred. It appears that EPA is only evaluating cis-1,2-DCE. How can 1,1-DCE be present at SIBW if TCA is not a contaminant of concern at this site? Where is the 1,1-DCE originating from and is it necessarily a degradation product? As stated in the text, it may be true that TCE is degrading to cis-1,2-DCE at SIBW but it does not explain the prevalence of 1,1-DCE. 1,1-DCE should be included in the risk calculation. Elimination of 1,1-DCE from consideration in the risk assessment may skew the outcome of the risk numbers to be lower than they actually should be. EPA is only using information generated from DCE Circuits. What about the other targeted source areas?	The sample-specific risk at each monitoring well was determined by quantifying the risk contributed by each VOC detected, including 1,1-DCE. Section 8.3.2.1 of the FS presents the results of an initial screening of the TCE plume at DCE Circuits (which was used as an example site because substantial data were available to determine, in general, whether biodegradation was taking place at IBW-South). According to the screening criteria listed in Table 8-1 of the FS, 1,1-DCE may be a daughter product of biodegradation of TCE in groundwater. However, as discussed on page 8-11 of the FS, 1,1-DCE is present due to biodegradation of TCE in the vadose zone (not groundwater) which then migrated to groundwater. 1,1-DCE was considered a COPC in groundwater and was not eliminated from the risk assessment.

Comments from Arizona Department of Water Resources

Dated 11/28/1997 by Mason R. Bolitho

No.	Comment	Response
4.0	In general, the Department supports the limited pumpage described in the proposed plan. While no volumes are specified, the Department believes that the minimum volume of groundwater necessary to achieve remedial action objectives should be withdrawn and that no regional containment pumpage should be undertaken. The area of Tempe in which IBW-South is located is generally served by surface water supplies and no critically needed sources of groundwater have been identified in either the Remedial Investigation or Feasibility Study.	The remedy does not include regional containment of the central and eastern UAU and MAU, but rather full containment and restoration of only the western UAU contaminated area. The central and eastern areas will be restored by natural attenuation, thereby minimizing pumpage at IBW-South. The State has classified the aquifer at IBW-South as a potential drinking water source.
5.0	The end use of remediated water from the Indian Bend Wash-South site is of great concern to the Department. In general, ADWR perceives new groundwater uses arising from remedial projects negatively because such new uses are contrary to the Phoenix Active Management Area's safe yield goal. It is essential that remediated groundwater from the IBW-South site be used in accordance with state law and put to reasonable and beneficial end use. The Department believes that appropriate uses for remediated water can be found that are acceptable to all parties, including EPA, ADEQ, ADWR, the City of Tempe, and others. The Proposed Plan properly states that beneficial end uses of remediated water will be determined at a later date.	As stated in the Proposed Plan, EPA's objectives for cleaning up IBW-South are to protect human health, cost-effectively reduce contamination in groundwater to meet cleanup levels (e.g., MCLs or Arizona HGBLs where MCLs are not available), to return groundwater to its beneficial use as a potential source of drinking water, and protect groundwater resources. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA will continue to discuss these end-use issues with ADWR and other parties. The end use/discharge option for remediated, extracted groundwater will be determined during remedial design, and its uses will be consistent with Arizona Law.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
FS1.0	Brown and Caldwell's evaluation of the FS supports the general remedial action objectives (RAOs) for remedial actions at the SIBW.	Comment is noted.
FS1.1	The trichloroethene (TCE) and tetrachloroethene (PCE) plumes for the upper alluvial unit (UAU) and middle alluvial unit (MAU) are shown as three general sets of plumes. Remedial alternatives evaluated a single combined extraction and treatment system for all plumes, and separate extraction and treatment systems for each well head. However, a remedial alternative that provides a separate extraction system and treatment system for each plume set was not evaluated. Because concentrations vary within each of the three plumes, it is likely that the length of operation will vary within each plume set. An additional alternative should be evaluated that looks at separate extraction system and treatment system for each plume set, or two extraction and treatment systems (one for the western plume and a second system for the central and eastern plume sets). While treatment system capital costs will be higher, the costs should be offset by the reduced piping costs and reduced operation and maintenance costs at the combined flow rate. The extraction well locations and flow rates for the new alternative should allow for effective capture as a combined system and as independent extraction systems.	Although the number and locations of treatment plants will be finalized during the remedial design phase, a multiple treatment plant scenario evaluated during the screening process of the Feasibility Study was not cost-effective. The additional alternative proposed by the commentor is unnecessary because the remedy relies on monitored natural attenuation for central and eastern areas of contamination. Should the contingency extraction and treatment remedy for any part of the IBW-South site be triggered, the treatment system issues raised here may be considered.
FS2.0	Given the numerous critical decisions that are based on the groundwater and solute transport model presented in Appendix 5, the model should include a detailed documentation, calibration and sensitivity analyses. Further, the model boundary conditions and distribution of hydraulic properties should reflect the level of field data that has been collected.	EPA has issued a memorandum supplementing the discussion of the groundwater modeling and presenting, in accordance with the American Society for Testing and Materials (ASTM), in one place modeling information that was previously dispersed throughout the RI/FS. That memorandum, entitled "Groundwater Monitoring Data for the Indian Bend Wash Superfund Site, South Area (IBW-South), Tempe, AZ," and dated August 12, 1998, has been added to the Administrative Record and mailed to the commentors who made similar comments about EPA's modeling effort. In addition, EPA has provided documentation of the groundwater data available since the FS cutoff date.
FS2.1	Evaluation of chemical concentration trends in regional monitoring wells shows that there is a likely general correlation between: (1) water-level elevation and chemical concentration; (2) travel distance and concentration from source; and (3) a generally decreasing trend in concentrations over time. These general trends should be quantified and included in the risk assessment evaluation, numerical modeling, or calculations for cleanup times.	The risk assessment included time series plots which presented the increased lifetime cancer risk estimates versus sample date. The information indicates that the potential for risk varies both up and down over time. One would expect groundwater concentrations to change over time at specific monitoring locations as groundwater migrates.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
FS2.2	A critical element of the length of operation and maintenance of a hydraulic control system is control of the volatile organic compound (VOC) sources. The only mention of source control provided in the FS is that soil vapor extraction will address residual concentrations of VOCs in soil and prohibit migration into the UAU. More detail needs to be included on the nature and extent of potential sources. In addition, the source evaluation needs to address hydrogeological issues that may affect the success of vapor extraction reducing groundwater concentrations (e.g., perched water conditions).	Although it is possible that the groundwater control system would have to operate for a longer period of time if soil gas contamination continues to release to the groundwater, the soil contamination is being addressed through EPA's 1993 VOCs in Vadose Zone OU ROD and the "Plug-In" process established in that ROD. Thus, the feasibility study evaluated alternatives with the assumption that sources in the soil above the water table would be removed. The RI provides data regarding VOCs in soil gas and soil and their sources, as well as a section that describes site geology and hydrogeology. Section 4 of the FS presents figures showing VOC distribution in the vadose zone. Concentrations of VOCs that exceed 10 milligrams per liter in soil gas generally provide a basis for subsite boundaries. More details regarding sources and localized conditions, if necessary, will be included in the Preliminary Property Investigation update and focused Remedial Investigation reports for soil subsites, which will be prepared in the near future. Further evaluations of specific issues, potentially including the hydrogeologic issues such as that described in the comment, occur in focused RIs and plug-in determinations. EPA believes that sufficient information exists and has been made available to the public on potential sources.
FS2.3	In general, the risk assessment presented in Appendix A is very conservative and likely represents an unrealistic scenario of groundwater use. Further, even with the conservative assumptions, the results of the risk assessment are inconclusive regarding the need for active treatment. Greater detail should be provided as to why active treatment is required.	The purpose of the baseline Risk Assessment is to evaluate current and reasonably likely future risks if no remedial action is taken. The future use scenario in which groundwater is used as drinking water is an appropriate and reasonably likely future use scenario for evaluation in a baseline risk assessment, given the previous use of groundwater as a source of drinking water, the possibility that it will be so used in the future and the State law declaring the aquifer as potential drinking water source. This potential exposure rate is by no means unrealistic. The Risk Assessment was performed in accordance with EPA guidance and regulations and was not unduly conservative. Active treatment is required at part of the site because without it, contaminated groundwater will migrate an unacceptable distance, and groundwater cleanup levels will not be achieved within a reasonable time frame. Groundwater that is classified as a drinking water source exceeds MCLs and other chemical-specific ARARs, necessitating remedial action. This is explained in this ROD, and need not be presented in the Risk Assessment.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
FS3.0	Comment re: Alternative 4. Section 8, Page 8-14 of the FS. Based on potential end use options, discharge of treated water to the Town Lake Project may not be feasible. Therefore, alternative end uses should be evaluated, such as injection wells and/or reuse of treated groundwater. With respect to injection wells, detail needs to be provided regarding the design of the injection wells. As a general rule of thumb, the long-term recharge rate is generally less than the expected withdrawal rate and, in the conceptual-design stage, the typical design recharge rate is one-half of the extraction rate. In addition, a typical injection well installation requires a surface pit for backwash pumping, chemical pretreatment for scale prevention, sediment removal to prevent clogging, and a down-hole control valve to prevent air entrainment. Based on the documentation provided in the FS, it is unclear what is included in the cost of the injection wells.	The FS evaluated three possible end uses. End uses of groundwater/discharge options will be addressed during the remedial design, but discharge to Town Lake does not seem infeasible at this time. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." In Appendix D of the FS, the estimated costs associated with each end use option are evaluated. Concerning the injection wells, a lump sum cost was used for all the capital costs associated with the installation of an injection well, and 2 percent of capital cost was used for all the annual O&M costs associated with the installation of an injection well. As stated in Appendix D, these "costs are approximate estimates made without detailed engineering data and in accordance with the guidelines of the American Association of Cost Engineers." The estimates are founded on cost curves and preliminary estimated quantities for major facility components.
FS3.1	Comment re: Section 8, Page 8-14 of the FS. The rationale for the selection of the treatment system location for each alternative should be provided.	Appendix D of the FS provides the rationale for the treatment system locations in Section D.2.1, Containment.
FS3.2	Comment re: Section 8, Figure 8-3 of the FS. Based on a review of the proposed site layout for the selected Alternative 4 (Figure 8-3), there appears to be unnecessary pipe needed to convey water from the extraction wells to the treatment system. Specifically, the pipe run from EWA-3 to EWA-7 is redundant. Additionally, it is unclear what the total extraction flow rate is for Alternative 4. On page 8-17 the listed extraction flow rate for Alternative 4 is 3,210 gallons per minute (gpm), on Figure 8-3, the summation of the listed flow rates is 5,530 gpm, and in Table E-2 the total flow rate is 5,550 gpm.	The conveyance pipeline between EWA-3 and EWA-7 was not included in the cost estimate and should not have been shown in Figure 8-3. The flow for EWA-3 is 1,080 gpm, not 1,060 gpm as shown in the figure.
FS3.3	Comment re: Risk Assessment, Appendix A of the FS. In the evaluation of the total increased lifetime cancer risk (ILCR) calculations, numerous ILCR calculations were significantly higher due to the presence of 1,2-dibromoethane. Details of the ILCR calculations indicate that the 1,2-dibromoethane is considered suspect. The ILCR time series plots included in Appendix A, Attachment A-1 should be revised to remove the effects of the suspect concentrations of 1,2-dibromoethane.	The risk assessment correctly notes the uncertainty of the analytical results which indicate the presence of 1,2-dibromoethane in groundwater. Removing the information from presentation in the time series plots would bias the presentation of results, which would be inappropriate. An important aspect of the risk assessment is that it consider the potential impact related to exposure to all constituents detected that may contribute significantly to the risk from groundwater exposure.
FS4.0	Comment re: Risk Assessment, Appendix A of the FS. Attachment A. Based on time series concentration plots for individual wells, there is justification for a downward trend in chemical concentrations over time. The ILCR calculations should address the potential effects of declining concentration trends over time.	The time series plots that relate the ILCR estimates to sample date do not show a definitive downward trend. In fact, the trend varies both up and down over time.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
FS4.1	Comment re: Risk Assessment, Appendix A of the FS. Section A.5.6 states that "EPA considers action to be warranted at a site when cancer risks exceed 10-4. Action is not required for risks falling within 1x10-4 to 1x10-6; however, this is judged on a case-by-case basis." Given the conservative assumptions and values used in the risk assessment and the low risk, the assessment does not definitely show that active treatment is warranted. EPA should provide detailed explanation of the decision to recommend active treatment.	Risks due to TCE and PCE exposure fall within the risk range of 1x10-4 and 1x10-6, and action may be warranted when contamination falls within this range. If residents were exposed to TCE and PCE in groundwater through drinking water or household uses, the potential for increased cancer risks and noncancer health effects exists. Action is warranted because contamination exceeds MCLs and other chemical-specific ARARs. Because the IBW-South aquifers are actual or potential sources of drinking water, active treatment is warranted to return those sources to their beneficial use. Moreover, without active treatment, the aquifer restoration goals would not be met within a reasonable time frame, and contaminants at levels above regulatory levels would migrate an unacceptable distance. See response to IMC Magnetics--Mr. Jenkins' Comment No. 01.0.
FS4.2	Comment re: Groundwater Flow and Solute Transport Analyses, Appendix E of the FS. The American Society for Testing and materials (ASTM) has developed general guidelines for the preparation of groundwater flow and contaminant transport models. ASTM D5718-95 - Standard Guide for Documenting a Groundwater Flow Model Application, covers suggested components to be included in documenting and archival of numerical groundwater flow models. This ASTM standard has been generally accepted by the professional community and by the EPA. Review of Appendix E found that many of the recommended portions of the modeling documentation were not included. Missing sections, or sections that were not completely documented included: conceptual model (as relates to model construction); sources and sinks; water budget; assumptions; limitations; rationale for boundary conditions; selection of calibration targets and goals; numerical parameters; calibration results; sensitivity analysis; model application verification; and electronic versions of model input and output files. Some of these sections were briefly mentioned, however, additional detail is needed to enable a comprehensive review of the model results. Calibration and sensitivity analysis for the chemical transport model should additionally be included.	EPA has issued a memorandum supplementing the discussion of the groundwater modeling and presenting, in accordance with the ASTM, in one place modeling information that was previously dispersed throughout the RI/FS. That memorandum, entitled "Groundwater Monitoring Data for the Indian Bend Wash Superfund Site, South Area (IBW-South), Tempe, AZ," and dated August 12, 1998, has been added to the Administrative Record and mailed to groundwater stakeholders and entered into the AR.
FS4.3	Comment re: Appendix E, Section E.1 of the FS. The EPA contractor, CH2MHill, has been responsible for the development of both the Town Lake Recharge/Recovery Model and the SIBW Groundwater Flow and Solute Transport Model. Due to the importance of the decisions being made based on the model simulations from both of these models, an independent review by a third-party contractor may be appropriate.	EPA has reviewed the work of its contractor. The modeling work has been scrutinized by many commentors. EPA does not see the need for further review.
FS5.0	Comment re: Appendix E, Section E.2.4.1 of the FS. Investigations that have been performed at the APS facility have encountered shallow bedrock conditions that extend into the UAU. The shallow bedrock conditions were found near the southwestern to south-central portion of the APS site, and would likely affect localized groundwater flow during pumping and should be included in the groundwater flow model. The APS site boring logs and additional boring logs in the vicinity of this bedrock feature should be evaluated to assess the potential effects to localized groundwater flow.	EPA is still evaluating APS's technical presentation concerning a bedrock diversion of groundwater flow. APS's hypothesis will be considered during the remedial design when EPA is assessing the contours and target volumes of the western plume to be extracted.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
FS5.1	Comment re: Appendix E, Section E.2 of the FS. Town Lake pumping and recharge should be included in the simulation scenarios.	EPA's modeling simulation included a range of groundwater flow scenarios that incorporated the effects of Town Lake pumping and recharge.
FS5.2	Comment re: Appendix E, Section E.2.4.2 of the FS. Groundwater extraction scenarios presented show significant stresses along the eastern and western model boundaries that invalidate the no-flow boundary conceptualization. East and west model boundaries should either be expanded beyond the zone of hydraulic stress, or change boundary type. In addition, stress along the southern boundary in the UAU should likely be adjusted to a prescribed flux or head dependent flow boundary.	The selected boundary conditions do not affect the model results. That is, the intent of the model was to estimate the number and location of extraction wells needed to hydraulically capture given target volumes, and to estimate rates of groundwater movement within the contaminant areas when there is no groundwater extraction (or limited extraction). The boundaries of the model are a sufficient distance from the contaminant areas, and the selected boundary conditions are appropriate given the available data. Additional documentation and discussion of the boundary conditions was provided in the technical memorandum "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998.
FS5.3	Comment re: Appendix E, Section E.6.1of the FS. Results of chemical analyses of groundwater samples have indicated a general downward trend in groundwater concentrations within the study area. The chemical transport model should be calibrated to these transient changes in concentration prior to making predictive simulations of chemical persistence.	The solute transport model results generally predict decreasing concentrations within the plumes that are similar to those observed. The lack of monitoring data in the downgradient portion of the plumes is a significant uncertainty that would not be resolved by additional sensitivity analyses or calibration. Moreover, some areas of groundwater at IBW-South have shown increasing, rather than decreasing, contaminant concentration levels.
FS5.4	Comment re: Appendix E, Section E.6.2 of the FS. Chemical concentration contours and results of chemical distribution calibration should be presented in a statistical and graphical format. Transient calibration of the effects of water-level changes should be performed.	See response to Arizona Public Service-Mr. Oliver's Comment No. FS5.3
FS5.5	Comment re: Appendix E, Section E.6.2 of the FS. Simulated chemical concentration contours should be presented and vertical cross sections should be prepared to show vertical capture and vertical distribution of chemical concentrations.	The available data, spacing of monitoring wells, and long screen intervals at each monitoring well do not warrant the preparation of the recommended figures.
FS6.0	Comment re: Appendix E, Section E.6.2 of the FS. Chemical travel and cleanup times at low concentrations are highly sensitive to the dispersion term. Sensitivity analyses of dispersion should be performed for the estimated chemical travel and cleanup times.	Sensitivity analyses were performed on the longitudinal dispersivity term as listed in Appendix E. The uncertainty in the predicted cleanup times and migration distances was considered when reviewing the solute transport results.

Comments from Arizona Public Service Company

Dated 9/4/1998 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
M1	On September 4, 1998, APS submitted comments on EPA's groundwater flow and solute transport model documented in the August 12, 1998, memorandum. In general, the comment stated that (1) improved documentation should be provided for selection of the hydraulic conductivity values in the groundwater flow model, (2) a bedrock high near the APS site was not considered and would affect capture zone estimates for the western contaminant area, (3) documentation of flow estimates into the MAU are difficult to follow, (4) a transient groundwater flow model should have been used, and (5) the chemical transport model was not calibrated to the declines in concentrations observed between 1994 and 1997.	Although this comment was submitted well after the close of the public comment period, EPA reviewed and considered this submittal from APS in selecting the final groundwater remedy for IBW-South. The comment contains no substantial support for any significant alteration of the remedial action. These comments were also discussed at the August 31, 1998, stakeholders' meeting in Phoenix, Arizona. APS's comments are included in the Administrative Record. EPA concluded that the comment would not alter the remedy selection. Regarding items 1 and 3, the amount of documentation regarding the hydraulic conductivities used in the model and the flows in the MAU is adequate. There was also a discussion in the August 12, 1998 technical memorandum regarding the sensitivity of the model results to changing the hydraulic conductivity (or transmissivity) values. Both of these parameters can be changed significantly without significantly affecting the comparison of remedial action alternatives. Regarding Item 2, the proposed remedy of extracting and treating groundwater in the western contaminant area would not be changed if a different transmissivity distribution were to be used near the bedrock high at the APS site. The water quality and groundwater level data indicate that the contaminants above MCLs have migrated a significant distance and will continue to migrate if hydraulic containment is not included in the remedial action for this contaminant area. Other comments were received regarding Item 4, and responses have been provided. See responses to Arizona Public Service Comments FS5.3 and FS5.4, and IMC Magnetics Corporation Comments 1-05.1, 4-1.0, 4-1.2, and 4-2.4. EPA believes the approach that was used, which evaluated a range of steady-state groundwater flow conditions, is justified. Other comments were also received regarding Item 5, and responses have been provided. See responses to Arizona Public Service Comments FS4.2, FS5.2, FS5.3, FS6.0, and RI8.0; and Unitog Comments 02-2, 09-1, 10-0, and 12-1.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
RI1.0	Review of chemical records and employee interviews show that volatile organic compounds (VOCs) were used only on a limited basis at the APS site and VOCs were not directly used in the power-generation process. Employee interviews have indicated that solvents, including tetrachloroethene (PCE), were used at the site for limited parts and machinery cleaning in the power-generation areas and occasional floor cleaning in the lube oil storage building. Solvents were used to clean equipment associated with the lubrication systems for the turbine units. During routine required maintenance, the lube oil would be drained, and the machinery would be cleaned with solvents. PCE has never been used as part of the power-generation process. Chemical purchase records document purchases of solvents for cleaning purposes. The solvent purchase records were submitted with APS' response to the Environmental Protection Agency's (EPA's) Section 104e request regarding site activities that was submitted to EPA on November 1, 1990. The majority of solvents purchased included trichloroethane (TCA) in aerosol cans and occasionally 55-gallon drums. There are no records showing purchase of PCE, however, there is reference to purchase of "Tri-O-Thane" and "Solvent 140", which may have contained PCE.	PCE has been found at high levels in the vapor in soils below and near the lube oil storage building area of APS's property. Onsite groundwater has had detectable levels of PCE. EPA will consider APS's comments regarding its solvent usage and disposal practices when addressing enforcement issues. EPA need not address these comments in the remedy selection document.
RI2.0	Soil gas surveys and soil gas monitoring at the APS site indicate that VOC-affected soil gas is confined to the area near the lube oil storage building and remedial efforts via soil vapor extraction (SVE) are underway to remediate concentrations in soil gas. Results of the soil vapor survey and subsequent soil gas sampling from soil vapor monitoring wells at APS indicated elevated concentrations of PCE and chloroform in soil gas. The concentrations of PCE are likely due to the limited use of PCE in the vicinity of the lube-oil storage building. The extent of the soil gas concentrations are confined to the area near the lube oil storage building and the vertical distribution of the PCE concentrations is consistent with a near surface release. In June 1997, a 3-month soil vapor extraction pilot test on soil vapor monitoring Well SMVW-2A was initiated. Preliminary analyses of the test data show that the pilot scale SVE system was successful in removing elevated VOC concentrations in soil gas. The concentrations of chloroform in soil vapor are believed by APS to be due to the reaction of chlorinated cooling water with organic material in the subsurface to form trihalomethanes, such as chloroform. Chlorination has been used as a biocide to prevent cooling tower fouling since the plant was put in operation the 1960s. In recent years, chlorine use was discontinued and replaced with a bromine based biocide.	EPA has considered and will in the future, as appropriate, consider APS's site investigatory findings.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
RI3.0	Laboratory analysis of groundwater samples collected from on-site monitoring at APS show VOC concentrations in groundwater that are well below EPA drinking water maximum contaminant levels (MCLs). Results of APS' preliminary evaluation of groundwater near the lube oil storage building and the property line found that only PCE and chloroform were detected at concentrations >1 µg/l in groundwater. PCE was not detected upgradient from the lube oil storage building. Detectable concentrations of PCE were found adjacent to the lube oil storage building, however, these concentrations decreased downgradient at the property boundary. Trichloroethene (TCE) or DCE was not detected in any of the groundwater samples. During the drilling of monitoring wells APS-5, and APS-11, bedrock was encountered at a depth of 100 feet bls and 105 feet bls, respectively. The bedrock encountered appeared to be a tertiary volcanic associated with competent bedrock that is reported to lie below the Red Unit. Based on water level elevation contours prepared for the site, the presence of the bedrock near Wells APS-5 and APS-11 does not appear to have a significant effect on groundwater flow under normal conditions. However, due to the decrease in saturated thickness south of APS-11 (approximately 40-foot decrease), it is likely that groundwater flow would be locally altered from a southwest flow direction to a more southerly direction. Further south of Well APS-11, the groundwater flow likely resumes a southwesterly flow direction. Chemical analyses collected from the on-site monitoring wells found detectable concentrations of chloroform in five monitoring wells and one well with detectable concentrations of PCE. Based on the three rounds of groundwater sampling that have been performed, PCE has only been detected in Well APS-ll at concentrations ranging from 1.5 µg/l to 1.9 µg/L Chloroform concentrations detected in monitoring wells along the southern boundary (APS-5, APS-11 and APS-6) range from 5.3 µg/L to 1.3 µg/L. No TCE or DCE has been detected in groundwater samples collected from the APS site. In summary, groundwater characterization at the APS site indicates that low levels of chloroform and PCE are present in the groundwater along the southern boundary of the site. The concentrations are well below the EPA drinking water MCLs for PCE (5 µg/l), and trihalomethanes, including chloroform (100 µg/1). Results of quarterly groundwater monitoring show stable concentrations of chloroform and PCE over time. The presumed source of the PCE in groundwater is the PCE-affected soil gas at the lube oil storage building. Residual concentrations of PCE in soil gas will be addressed in the proposed SVE remedial system. Abatement of PCE in soil and soil gas beneath the lube oil storage building will likely prevent future contributions to groundwater. Further, it is expected that continued groundwater monitoring will show decreasing PCE and chloroform concentrations along the downgradient (southern) boundary of the APS site.	EPA is still evaluating APS's technical presentation concerning a bedrock diversion of groundwater flow. APS's hypothesis will be considered during the remedial design when EPA is assessing the contours and target volumes of the western plume to be extracted. EPA is also hopeful that SVE will prevent future contributions of VOCs in soil to groundwater.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
RI4.0	EPA's depiction of the VOC distribution in the Study Area does not associate the APS site with any of the groundwater plumes that are to be remediated by the regional extraction system proposed in the FS. Section 6 of the SIBW RI discusses the nature and extent of regional groundwater contamination. Figure 6-39 of the RI present the extent of contamination in the UAU. The distribution of TCE contamination in the UAU shows two plumes: one originating near Well SIBW-5U that is approximately 1,200 feet south of the APS site; and second plume focused on Well SIBW-20U that is approximately 1,200 feet east of the APS site. Distribution of PCE in the UAU indicates a source of PCE near Well SIBW-5U, SIBW-3U and Well SIBW-51U. The source near SIBW-5U correlates to the UAU TCE source. Well SIBW-3U, which is located approximately 1,000 feet south-southeast of the property, is shown as a small plume with low concentrations (<6 µg/L PCE). The PCE plume originating near Well SIBW-51U is approximately 6,000 feet east of the APS Facility and extends approximately 2 miles to the south.	The sampling data from APS wells were not collected prior to the data cutoff date for inclusion within the EPA groundwater RI and FS. EPA has since reviewed data collected and submitted by APS. In December 1997, EPA advised APS that the APS site may be associated with the western area of contamination. Very briefly, PCE has been found in soil gas onsite, and in groundwater at low levels. This PCE may have migrated to groundwater and commingled with the westernmost area of contamination onsite. EPA's depiction of the estimated areas of contamination is based on data and is for illustration purposes, not for disassociating specific sources from contaminant areas.
RI5.0	Significantly, neither the TCE nor PCE plumes presented in the SIBW RI indicate that the APS site is a source, or contributor to the regional plumes. The only plume shown to extend beneath the APS Facility is the TCE plume originating near Well SIBW-21U. The TCE plume as depicted in Figure 6-39 of the RI shows the plume extending beneath the APS site across the extreme southeast corner. EPA represents this plume as migrating beneath the APS site from an upgradient source. It should be noted that the small portion of the plume is based on EPA interpretation of surrounding monitoring wells and TCE has never been detected in groundwater samples collected at the APS site.	See response to Arizona Public Comment-Mr. Oliver's Comment No. RI4.0.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
RI5.1	Based on an evaluation of on-site and off-site water level elevations and distribution of VOCs in groundwater, the low concentrations are confined to the vicinity of the APS site and not connected to the regional VOC contamination. Based on the nature and extent of contamination that was presented in the SIBW RI, the only source that has been-identified downgradient of the APS site is the TCE source related to concentrations in Well SIBW-5U. Well SIBW-5U is a UAU well located on the DCE Circuits property (one of the eight identified subsites) and has been sampled since 1991. The primary constituent is TCE which has been detected at concentrations up to 540 µg/l. PCE has been consistently found at concentrations up to 35 µg/l, which is significantly higher than any PCE concentrations detected in groundwater at the APS site. Chloroform has inconsistently been found in approximately 38 percent of the samples at concentrations ranging from non-detectable to 4 µg/L. Comparison of contaminant concentrations at the DCE circuit facility and the APS site finds that the percentage of VOCs in soil gas at APS's site is dominated by PCE with lower concentrations of chloroform. VOCs detected in groundwater monitoring wells at the APS site have detected primarily chloroform with a lower percentage of PCE. In contrast, VOCs in soil gas samples from the DCE circuit site are mostly TCE with lower concentrations of PCE, TCA, chloroform and DCE. Groundwater samples collected at the DCE circuit site (Well SIBW-5U) show a similar distribution of VOCs with the exception of an increased percentage of DCE that is believed to be due to the breakdown of TCE in the vadose zone. The closest monitoring wells downgradient of the APS site are the Superlite Block wells. The Superlite Block site is located between the APS Facility and Well SIBW-5U, on the southern side of University Drive. The Superlite Block site is an underground storage tank (UST) site that has undergone remediation for elevated concentrations of fuel-related compounds. As part of the UST investigation, 8 monitoring wells have been installed within a 120-foot radius. These wells are clustered approximately 200 feet due south of APS Wells APS-11 and APS-6. The Superlite Block wells are located downgradient and slightly cross-gradient of the normal (non-river flow) groundwater flow direction. However, presence of shallow bedrock south of Well APS-11 likely causes a localized perturbation in the regional groundwater flow direction, and the preferential groundwater flow path more due south before returning to the regional southwestern direction. Nevertheless, because of the limited information available on the configuration of the bedrock surface, it is difficult to make definitive statements of the potential effects to groundwater flow. The concentrations of chloroform at the southern boundary of the APS site and the	EPA believes that APS may have contributed to the contamination in the western contaminated area at IBW-South. EPA will continue its separate discussions with APS concerning this issue when appropriate. See response to Arizona Public Service-Mr. Oliver's Comment No. RI4.0. EPA also will discuss the divisibility issue with APS. Such enforcement issues need not be addressed in the remedy selection document. To the extent that groundwater flow pattern is relevant to an extraction system in the western area of contamination, it will be evaluated during remedial design.

No.	Comment	Response
	consistent presence of chloroform in the groundwater samples collected from the Superlite Block wells support the migration pathway from the APS site to the Superlite Block site. In addition, the infrequent-low levels of PCE detected in the Superlite Block wells show that the extent of the PCE concentrations from the APS site are limited to the vicinity of the APS site. The chemical "signature" of the VOCs detected at the APS site based on the downgradient monitoring well APS-11 is approximately equal concentrations of chloroform and PCE. No detectable concentrations of TCE, TCA, 1,2-DCE or 1,2-dichloroethane (1,2 DCA) have been detected in groundwater samples collected from the APS site. Concentrations detected at well SIBW-5U and monitoring wells downgradient of DCE circuits (Wells SIBW-23, SIBW-41, SIBW-40U and SIBW-28U) show a chemical signature that is primarily TCE with lower concentrations of 1,2-DCE and PCE (Figure 5). This difference in the chemical signature further supports that the APS site is separate and divisible from the regional groundwater plumes.	
RI7.0	VOC contamination present at the APS site is separate and divisible from the regional contamination identified in the RI.	See response to Arizona Public Service-Mr. Oliver's Comment No. RI5.1.
RI7.1	Review of the data related to chemical use history, potential source areas, groundwater flow, distribution and signature of chemicals in the aquifers, and known chemical releases leads us to the conclusion that the APS site has not contributed to the regional groundwater contamination that is the subject of EPA's proposed remedy.	See response to Arizona Public Service-Mr. Oliver's Comment No. RI5.1.
RI7.2	The figures showing the extent of VOCs in groundwater presented in Section 6 should be shown as concentration contours for a specific time period.	The contours in Figures 6-39 and 6-40 of the RI depict the estimated extent of TCE and PCE contamination in the UAU and MAU aquifers, respectively. Figures 6-20 through 6-27, which do not have contour lines, plot either maximum contaminant concentrations, or contaminant concentrations for a specific sampling event. Contours are not necessary to convey this information.
RI8.0	Review of chemical concentration trends in groundwater indicate that there is a general trend in decreasing chemical concentrations. These declines should be quantified and used for future chemical predictions.	The chemical concentration trends and some factors, such as the change in water levels which may influence them, are discussed in Section 6 of the RI. The number and variability of these possibly controlling factors that may occur at any particular well is discussed. The technical memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, presents time series plots of chemical concentrations at selected wells.
RI8.1	The groundwater data base presented in Appendix 4 of the RI should include all sampling events, including 1997.	EPA has updated the groundwater data with data obtained since the data used in the RI and FS. These data are included in the August 12, 1998, Technical Memorandum re "Groundwater Monitoring Data for the Indian Bend Wash Superfund Site, South Area (IBW-South) Tempe, AZ" which is part of the Administrative Record.

Comments from Arizona Public Service Company

Dated 11/26/1997 by James M. Oliver, R.G., for Brown and Caldwell

No.	Comment	Response
RI8.2	The preliminary property investigation (PPI) has an incomplete description of the APS production wells; the section should be replaced with the description presented in APS's Phase II Site Investigation (Brown and Caldwell, 1996).	Subsite-specific updated information will either be presented in the PPIs which are part of the overall IBW-South RI, or the subsite-specific reports and Focused RIs will be incorporated into the RI by reference and included in the site file.
RI8.3	The APS PPI references a dry well in the lube oil storage building. There was no dry well constructed in the lube oil storage building. Based on employee interviews, the lube oil storage building drain was plugged with concrete in 1983.	See response to Arizona Public Service-Mr. Oliver's Comment No. RI8.2.
RI8.4	The APS PPI should include summaries of additional soil gas, and groundwater monitoring that have been performed at the APS site.	See response to Arizona Public Service-Mr. Oliver's Comment No. RI8.2.

Comments from City of Tempe

Dated 8/8/1998 by Bill Coughlin and Eric S. Kamienski

No.	Comment	Response
GM1	On August 28, 1998, the City of Tempe submitted comments on EPA's groundwater flow and solute transport model documented in the August 12, 1998, memorandum. In general, comments were made regarding (1) several components of the water budget (Town Lake leakage, values used for regional pumping, value used for cascading flow at SRP Well 23E, 2.9N), (2) EPA's conclusion that the Salt River does not act as a groundwater divide during non-riverflow conditions, and (3) the City's concurrence with the portion of the proposed remedy that requires groundwater extraction in the Western UAU contaminant area.	Although this comment was submitted well after the close of the public comment period, EPA reviewed and considered this submittal from the City of Tempe in selecting the final groundwater remedy for IBW-South. The comment contains no substantial support for any significant alteration of the remedial action. Most of these comments were also discussed at the August 31, 1998, stakeholders' meeting in Phoenix, AZ. The City of Tempe's comments are included in the Administrative Record. EPA concluded that the comment would not alter the remedy selection. The groundwater flow model did not assume that Town Lake would provide a long term source of water to the UAU in the non-riverflow condition. Other terms summarized on pages 7 and 8 of the August 12, 1998 technical memorandum are results of a water budget analysis presented in the RI. These are not input parameters used in the groundwater flow model. The regional groundwater pumping values summarized in the water budget were evaluated during the RI. These pumping values were not used explicitly in the groundwater flow model, rather the model was calibrated to the resulting horizontal and vertical groundwater flow patterns. Regarding the cascading flow in SRP 23E, 2.9N, this value was based on spinner logging performed at the well. Also see response to SRP Comment 3.0. Regarding Item (2), we used the term non-riverflow event to represent the groundwater conditions that are no longer affected by a prior flow event in the river. During the time periods following a river flow event, the water levels do suggest that there is still a groundwater divide at the riverbed.

Comments from City of Tempe

Dated 10/28/1998 by Gary Brown

No.	Comment	Response
1	The Tempe City Council's direction is for City staff to express a strong interest to the EPA on the feasibility of using the remediated water in the Rio Salado Town Lake. It is important to the City of Tempe that the EPA groundwater cleanup moves forward. We appreciate EPA's continued efforts in working with the City on this issue. We're excited about the possibilities that this idea brings for our Town Lake and the Rio Salado Project.	The Rio Salado Town Lake is a viable end use option. However, as stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." End use/discharge options will be addressed during the remedial design phase. EPA looks forward to continued work with the City of Tempe.

Comments from City of Tempe

Dated 11/25/1997 by Karen S. Gaylord

No.	Comment	Response
1.0	The City has several goals for the efforts at SIBW. The first is to protect downgradient City wells from further spread of contamination. The second is to eventually restore to use the City well which has already been impacted. The third is to pump only that groundwater which is necessary to accomplish the first two goals. It appears that EPA's preferred alternative takes all three of these goals into consideration.	EPA's remedial action objectives include the restoration of groundwater to its beneficial use as a drinking water and to limit migration of contamination. The selected remedy includes MNA to restore the central and eastern contaminated areas; thus minimizing pumpage at IBW-South. EPA believes its goals and those of the City of Tempe are consistent.
1.1	While the regional containment alternatives would seem to accomplish the City of Tempe first two goals more completely and much more quickly, the City is concerned over the huge volumes of groundwater which would be pumped under these alternatives. The City has invested heavily in its water conservation programs so that it may rely on this groundwater resource during drought conditions, and during shutdown of its surface water treatment plants. While the EPA's preferred alternative of partial containment will allow for some migration and dispersion of the plume, it seems that downgradient City wells will not be jeopardized, and well #7 should eventually be returned to City use. For these reasons the City endorses EPA's preferred alternative #4.	EPA agrees with the City's comment.
1.2	The City would like to express its strong interest in use of the remediated water which will result from these cleanup efforts, in the City's Rio Salado Project. Under this end use scenario, the remediated water would be discharged to the Tempe Rio Salado Project's Town Lake. The remediated water would make up evaporative and seepage losses from the lake, and would help maintain water quality. Logistical and water rights issues must be resolved, but the City is committed to work with EPA to explore the feasibility of this end use option.	The Rio Salado Town Lake is a viable end use option. However, as stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA looks forward to continued work with the City of Tempe.
2.0	The City cannot endorse the alternative end use options. In particular, a number of Tempe residents have expressed to us their concerns regarding discharge of remediated water to the SRP canal number 6. While remediated water which has been treated to drinking water standards is safe for potable delivery, our residents seem to want the greater margin of safety afforted by non potable use of remediated water.	EPA recognizes the concerns of some members of the community about the SRP Canal end-use option and will take these concerns under consideration during the final end-use determination. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA will continue to involve the City in end-use issues during remedial design.
2.1	The City is concerned over one aspect of the proposed remedy. The City notes that EPA proposes a groundwater use restriction for the SIBW area. The City would like to further discuss with EPA the nature and extent of this restriction and its impact on the City's use of its Well #7.	EPA will rely on Arizona well siting, permitting, and construction restrictions to protect the public from exposure to contaminated groundwater. As stated in the Proposed Plan, the wellhead treatment alternative for COT Well No. 7 was evaluated by EPA to allow the City of Tempe to provide water meeting drinking water standards for use in emergencies or during drought conditions. EPA looks forward to continued work with the City of Tempe.

Comments from City of Tempe

Dated 11/25/1997 by Karen S. Gaylord

No.	Comment	Response
2.2	Finally, the City would like to commend EPA for the work it has done in finalizing this proposed plan. We are anxious to have the cleanup efforts begin as soon as possible. Over half of the City's wells are now off-line due to concerns over groundwater contamination. The City is landlocked and has no pristine undeveloped areas into which it can tap for new wells. Existing groundwater contamination within the City of Tempe must be contained in order to preserve the City's ability to deliver water during drought or emergency shutdown conditions. We urge EPA to continue its present efforts toward expeditious containment of this contamination, and eventual restoration of the groundwater resources on which the City relies.	EPA understands that the City derives its drinking water from surface-water supplies. Nonetheless, EPA appreciates the City's comments and is working to expedite the remedial action to restore groundwater to its beneficial use as a potential source of drinking water.

Comments from Dava/Lakeshore Neighborhood Association

Dated 11/18/1997 by Kathyanne M. Pera

No.	Comment	Response
1.0	On behalf of the Association, and the 500 homeowners which we represent, we wish to express our extreme shock and dismay with respect to the EPA's September 1997 report on the above site in Tempe, AZ. Choosing to drain treated contaminated water into a system set up as a drinking water source is a flagrant act of irresponsibility on the part of the EPA. The Salt River Project Tempe Canal No. 6, a possible destination for the treated effluent, serves thousands of homes in the area, with several additional hundred homes planned for construction. We were very impressed with your willingness to remediate a contaminated area; however, in your report, and I quote "...extraction and treatment of a portion of the VOC-contaminated groundwater..." fails to assure us that our neighborhoods will be secure from accidental overextraction. Furthermore, we know that "routine" monitoring of the groundwater before and after treatment cannot guarantee that contaminated water will not be consumed. On behalf of this neighborhood association, we strongly support the least offensive solution, which would be to place the water in a storm drain leading to the Salt River. This would at least allow the issue to be again addressed in the planning and construction of the Rio Salado Project, which will be ongoing for many months.	Should discharge to SRP Tempe Canal No. 6 occur, the water discharged would be treated to remove contamination to health-based levels to eliminate risks, thereby protecting the public. That end use is not irresponsible on EPA's part. The end use/discharge option will be determined during remedial design. EPA will consider the community's comments during that process. EPA will continue to evaluate over time both the target volumes appropriate for extraction and the effectiveness of monitored natural attenuation to reduce a risk of "accidental overextraction." Institutional controls and continued monitoring will reduce the risk of consumption of contaminated groundwater.
1.1	There was no notice of your meeting held on Wednesday, September 24, 1997, to our neighborhood association, or to my knowledge, any other neighborhood or homeowner association in the affected area. Why?	Notice was published on September 15, 1997, in the Arizona Republic. Notice was also provided in the Proposed Plan, which was sent to all of those on the SIBW mailing list.

Comments from Dava/Lakeshore Neighborhood Association

Dated 11/18/1997 by Kathyanne M. Pera

No.	Comment	Response
1.2	Your report indicates that the remedies proposed will provide cleanup levels achieved within "...a reasonable time period of 30-50 years..." This time period hardly seems reasonable. Essentially then what will occur is that during that 30-50 years the people consuming this water will be guinea pigs for the effects of the treatment. This is simply unacceptable.	Residents of the City of Tempe (COT) are not served contaminated groundwater; they receive surface waters as drinking water. According to COT's 100-year water management plan, COT expects to continue using surface waters as its primary source of drinking water. All groundwater extracted for the CERCLA remedial action will be treated to health-based levels (I.e., MCLs or Arizona HBGLs). Each of the three possible treatment processes to be used has been used considerably over the course of many cleanup actions. Thus, if extracted and treated groundwater is consumed, it will be treated to below health-based levels. Furthermore, EPA will work with the Arizona Department of Water Resources and other agencies to ensure that Arizona well siting, permitting, and construction requirements, as well as notices to those seeking to install new wells, minimize the risk of exposure to contaminated groundwater at IBW-South. The reasonableness of the remedial time frame varies with the nature and extent of the contamination and other site circumstances. EPA in its September 30, 1998, ROD has revised the anticipated remedial time frame, reducing it to approximately 30 years. This time frame of 30 years is consistent with modeling performed by EPA to predict aquifer restoration time frames for the various areas of VOC contamination at IBW-South using both extraction and treatment, and monitored natural attenuation. This time frame is reasonable and is shorter than the time frame proposed in the Proposed Plan. This time frame is consistent with such time frames in other actions.
2.0	While the remedies suggested are in your words "the most cost effective", I feel that it is equally important to consider the source of this contamination, which appears to originate in the upper or northern Indian Bend Wash site, which is located not in Tempe, but in Scottsdale. Who will be charged for the cleanup? Tempe or Scottsdale? If the proposed remedies are accepted, it would appear that the City of Tempe would bear the cost of this treatment and the aftereffects of its potential ineffectual result. That seems unfair to the citizens of the City of Tempe.	There are multiple sources for the groundwater contamination at IBW-South, all of which are located within and near the City of Tempe. As the RI concluded, there is no evidence of any contamination from IBW-North or Scottsdale reaching IBW-South. The City of Tempe is not currently a PRP, and it is not anticipated that either city will be required to pay for the IBW-South groundwater remedy.
2.1	I sincerely hope that you will respond to my concerns, and the concerns of others living in this area, by considering that your proposed remedies may not be in the best interests of the citizens and taxpayers who will bear the burden of the cost of remediation and the future consequences of consuming the water.	EPA has considered the comments received from the City of Tempe and community members, and believes the selected remedy is in the best interests of, and is generally supported by, citizens in and around the City of Tempe. EPA has also considered whether the remedy is protective of human health and the environment, and finds that it is. See response to your Comment 2.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
01.0	Contrary to EPA's assertions in the FS and Proposed Plan, the data clearly indicate that remedial action is not justified for the Site. There simply is no significant risk to human health or the environment. The concentrations of contaminants in the groundwater have decreased dramatically in recent years and a realistic analysis of the data indicate that even without active remediation there will be no concentrations above maximum contaminant levels ("MCLs") in any of the plumes by the year 2011. Therefore EPA's selection of any active remediation, and in particular alternative No. 4 as its preferred alternative, violates the provisions of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") and is inconsistent with the National Contingency Plan ("NCP") and EPA's own guidance documents. Accordingly, if EPA selects its preferred alternative as the final remedy for the Site, such selection would be arbitrary and capricious, rendering that remedy invalid and unenforceable, and EPA's costs associated with the Site inconsistent with the NCP and, therefore, unrecoverable.	The NCP requires response actions at sites where risk equals or exceeds 1x10-4, and gives EPA discretion to take active remedial measures where risks exist in the range of 1x10-4 to 1x10-6. At IBW-South, 1,2-dibromoethane and benzene pose risks greater than 1x10-4, while TCE and PCE pose risks within the 1x10-4 to 1x10-6 range. Remedial action is warranted under those circumstances, and it is necessary at IBW-South. Remedial action is generally warranted where, as here, MCLs or non-zero MCLGs are exceeded (other chemical-specific ARARs also may be used to determine whether action is warranted). EPA modeling further indicates the necessity of remedial action. Without active extraction and treatment, the western area of contamination will not be restored to aquifer cleanup levels or to its beneficial use as a drinking water, as expected by the NCP, within a reasonable timeframe. EPA would also be unable to prevent unacceptable migration of contaminated groundwater to uncontaminated areas, for more than one-half mile. EPA has selected MNA to remediate the central and eastern contaminant areas, and these efforts are also warranted; without monitoring, EPA will be unable to determine if MNA is occurring or if the contingency remedy is necessary in order to limit migration of contaminated groundwater to uncontaminated areas, or to ensure the aquifer is restored to cleanup levels within a reasonable timeframe. Selection of the preferred remedy as described in the Proposed Plan also would be warranted under the NCP to expedite cleanup. In sum, EPA's remedial selection in this ROD does not violate CERCLA, is consistent with the NCP and EPA Guidance, and is not arbitrary, capricious, invalid, or unenforceable; EPA's costs are not inconsistent with the NCP and are recoverable.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
02.0	In its assessment of the incremental lifetime cancer risks ("ILCR") associated with groundwater at the Site, EPA has made assumptions which are overly conservative and not representative of conditions at the Site. Risk assessments are to be based on the "reasonable maximum exposure scenario." "Reasonable maximum" is defined such that only potential exposures that are likely to occur will be included in the assessment of exposures. The assumption of future residential use may not be justified if the probability that the site will support residential use in the future is small. Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that is not appropriate. In its risk assessment, EPA assumes that the reasonable maximum exposure is represented by residential use at any and every point throughout the contaminated plumes. This assumption is clearly inappropriate, as no residential wells are present within the contaminated plumes or in close downgradient proximity of the plumes, groundwater in the vicinity of the Site is not currently used as public water supply, the City of Tempe's current and submitted-for-renewal 100-year assured water supply certificates do not rely on the use of groundwater for municipal supply, and a myriad of unenforceable regulatory and institutional controls already exist to prohibit installation of new residential wells.	Evaluation of potential future exposures associated with contaminants in groundwater is consistent with EPA's risk assessment guidelines. In addition, Tempe's 2000 General Plan Summary calls for rezoning to mixed use more than 50 acres of lands in the area. A portion of that land will be residential. Considerations of current land use or institutional controls as the only reasons for excluding future exposure pathways from contaminants in groundwater would be inappropriate; it would not be reasonable to assume that zoning or institutional controls could not change over time. Therefore, the facts that current land use is not residential, and that institutional controls limit installation of new residential wells by themselves are insufficient reason for excluding potential future exposures from the risk assessment. Drinking water supply wells exist at IBW-South, and the State classifies the aquifer as a potential source of drinking water; the City of Tempe desires the water to be restored for potential use. Thus, groundwater at IBW-South is a potential source of exposure to VOC contaminants. These factors are important considerations in characterization of the numerical risk estimates.
03.0	In estimating the concentration of contamination at which an exposure would occur at a residential point of use over time, EPA's risk assessment uses maximum historical concentrations to characterize exposure. The existing data, however, clearly indicate that contaminant concentrations have decreased since initiation of the RI/FS, and will continue to decrease. EPA's failure to consider the clear temporal trends exhibited by the groundwater quality data results in an unrepresentative characterization of the exposure concentration on which the ILCR is based.	EPA guidance (RAGS Part A) states that current groundwater concentrations can be used to represent future concentrations in groundwater assuming steady-state conditions. The risk assessment acknowledges that groundwater contaminant concentrations fluctuate over time, leading to fluctuations in risk and ICLR over time.
04.0	IMC has recalculated ILCRs by correcting EPA's use of maximum historical concentrations, but retaining EPA's overly conservative assumptions regarding residential exposure and intake. The corrected predicted risk does not warrant response action. Baseline risk levels of 10-4 or less do not generally require action. Concentrations greater than MCLs in groundwater only trigger response action if exposure to contaminants above MCLs is predicted for the reasonable maximum exposure. That is not the case here. When assumptions more consistent with standard practice and more representative of actual concentrations observed are used, EPA's algorithms produce a maximum calculated ILCR of 2 X 10-6 at the point of maximum concentration in the western plume, and less than 1 X 10-6 at the vast majority of all other locations in the plume. The maximum calculated ILCR in the central plume is 1 X 10-6 at the point of maximum concentration, and less than 1 X 10-6 at all other locations. Such predicted risks do not justify remedial action.	EPA does not agree that the commentor has made a case that the revised risk calculations are consistent with a reasonable maximum exposure scenario. Risks estimated for historical concentrations of TCE and PCE in most wells fell within the 1 x 10-6 to 1 x 10-4 risk range. While the points suggested by the commentor could refine the risk assessment, they do not address the concern that contaminant concentrations in groundwater exceed MCLs. Remedial action is generally warranted where, as here, MCLs or other chemical-specific ARARs are exceeded. See response to IMC Magnetics-Mr. Jenkins' Comment 01.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
05.0	The SIBW has never been independently ranked under the Hazard Ranking Systems (HRS). EPA originally ranked the IBW site in 1983 under the assumption that what are now designated as the North and South areas were interrelated. In fact, however, the SIBW is hydrogeologically separate from the North Indian Bend Wash (NIBW) site. Faced with this fact, EPA divided the IBW into a north and a south area, but never rescored the two sites. The law is clear that EPA may not aggregate non-contiguous sites that would not separately qualify for listing on the NPL. In fact, EPA must apply CERCLA's risk-based scoring criteria to each and every non-contiguous site. It has not done so for the SIBW or the central and western plumes. We believe that the SIBW as a whole, and certainly the separate central plume area, would score below the HRS threshold. Therefore, EPA may not aggregate the SIBW with the NIBW or the central plume area of the SIBW with the western plume area. Accordingly, EPA should delist the SIBW or, at a minimum, the central plume area.	EPA lists a Superfund site on the National Priorities List based on the "relative risk or danger to public health or welfare or the environment." CERCLA, 42 U.S.C. Section 9605(a)(8)(A). At the time of the NPL listing, the relative risks and danger to public health, welfare and the environment were evaluated for the Indian Bend Wash Superfund Site based on information then known. The nature and extent of the release, including site boundaries and the threat posed by the release, were studied throughout the RI/FS and risk assessment process, and the boundaries included all releases discovered during that process. Additionally, only after the NPL listing was the Site divided, for administrative reasons, into two study areas (but not two sites). And, only after the NPL listing was it gradually learned that the north and south areas, which are contaminated with the same volatile organic compounds, were not interconnected and that the sources of contamination for each area were separate. Thus, this is not a case of aggregating two sites known to be noncontiguous.
06.0	EPA's selection of alternative No. 4 as its preferred alternative violates the provisions of CERCLA and is inconsistent with the NCP and EPA's own guidance because alternative No. 4 is not the lowest-cost alternative that is protective of human health and the environment and meets all applicable or relevant and appropriate requirements ("ARARs").	The selected remedy is the lowest-cost alternative that is protective and meets ARARs and EPA's remedial action objectives within a reasonable timeframe of approximately 30 years. In any event, the NCP does not require selection of the lowest-cost alternative that is protective of human health and the environment and that achieves ARARs.
06.1	In the Proposed Plan, EPA concludes that only alternative Nos. 4, 5 and 6 are protective of human health and the environment and compliant with ARARs. This conclusion is not supported by the data and other evidence. Alternative Nos. 1 and 2 (natural attenuation and natural attenuation with monitoring) are comparably effective with alternative Nos. 4 through 6.	The Proposed Plan states that Alternative 1 is not protective because no actions are taken to restrict exposure or monitor the progress and migration of the contaminants. The Proposed Plan also states that Alternative 1 and Alternative 2 are not protective within the reasonable time frame of 100 years and the contamination could migrate a significant distance, contaminating clean aquifer areas. These statements are consistent with the information provided within the FS. Therefore, Alternatives 1 and 2 are not as protective of human health and the environment as are Alternatives 4 through 6, and would not be appropriate at IBW-South. Based on review of more current data, EPA believes that MNA will be a protective remedy to address VOC contamination in the central and eastern areas of contamination.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
06.2	EPA rejected alternative Nos. 1 and 2 because EPA concluded natural attenuation was not protective of human health and the environment. That conclusion is incorrect. EPA based its conclusion on its view that biodegradation was not demonstrated and other natural attenuation alone will not meet MCLs within a reasonable time frame. It also noted that the plume would migrate a significant distance. This is contrary to the data. EPA identifies a reasonable time frame as less than 100 years. Proposed Plan, p.8. Where longer remediation time frames are appropriate, less aggressive remediation methods and/or more passive remediation approaches (such as source control combined with natural attenuation) are appropriate. Natural attenuation is most likely to be appropriate in plumes with low concentration and where biodegradation will effectively destroy the contaminants in situ. A proper evaluation of the data, in conjunction with IMC's groundwater modeling, demonstrates that natural attenuation is appropriate for the SIBW and in fact, remediation by natural attenuation will achieve MCLs by the year 2011. Consequently, consideration of alternatives other than those based on natural attenuation is not supportable.	The groundwater modeling evaluation was updated since the FS and documented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. These revised results indicate that the western contaminant area would migrate at least 7,000 feet and still be above the aquifer cleanup standards of 5 ppb for TCE. EPA's selected remedy does incorporate monitored natural attenuation in the other parts of the site based on data from the RI and modeling from the FS and more recent data and modeling indicating that natural attenuation of VOC contaminants is occurring. See also response to Dava/Lakeshore Neighborhood Association's Comment No. 1.2. For the western contaminant area in the UAU, the data indicate that significant migration will occur and that the western area will not be remediated to aquifer cleanup standards within a reasonable time frame if some groundwater extraction is not implemented.
07.0	In concluding that biodegradation is an insignificant factor in natural attenuation at the Site, EPA has improperly considered the existing data, which provide clear evidence of active biodegradation of trichloroethylene ("TCE") in the Western plume, the only area where TCE concentrations are great enough to evaluate related catabolic breakdown products. In this area, a strong correlation actually exists between TCE and its catabolites which cannot be attributed to vadose zone degradation. Further, IMC has developed analytical data which clearly demonstrate the presence of bacterial communities in the aquifer in the central plume area which biodegrade TCE. EPA's incomplete analysis of the existing data in itself casts doubt on the conclusion that natural attenuation will not be effective at the Site. In combination with the direct evidence of active and ongoing biodegradation of TCE presented by IMC, EPA's conclusion must be considered unfounded and incorrect.	The existing data indicate that even though biodegradation is occurring in limited areas at the site, the rate of natural attenuation is not as great as the rate of groundwater movement in some contaminated areas. The dilution and dispersion processes are more significant factors in reduction in contaminant concentrations. There are no widespread areas at the site in which the conditions support significant amounts of biodegradation. EPA's selected remedy does incorporate monitored natural attenuation in some portions of the site.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
08.0	In order to establish the time frame in which natural attenuation, including biodegradation, will achieve MCLs at the Site, IMC has modeled plume dynamics using BIOSCREEN and found a good fit among observed concentrations when biodegradation is incorporated in the model (a poor fit is achieved when biodegradation is discounted). The calibrated model demonstrates that MCLs will be achieved in 15 years or less in the western plume and central plumes. The calibrated model also demonstrates that concentrations of TCE above the MCL will not occur outside the SIBW, or in other words, that TCE above MCLs will not migrate to locations outside the Site. EPA's comparable analysis, that TCE at concentrations above the MCL will migrate significant distances, is unreliable as a result of EPA's assumption regarding the absence of biodegradation and basic flaws in EPA's groundwater modeling. Because natural attenuation will achieve MCLs within a very short time frame, and because contamination at concentrations greater than MCLs will not migrate outside the Site, alternative Nos. 1 and 2 must be considered protective of human health and the environment and will comply with ARARs in a comparable time frame as EPA's preferred alternative. Thus, EPA must include Nos. 1 and 2 in the cost-effectiveness portion of its alternatives comparison.	EPA does not agree that the commentor's modeling should be adopted in place of EPA's own modeling. Under EPA's modeling, as updated and provided to stakeholders and entered into the RI, natural attenuation alone will not result in the remediation of the western contaminant area within a reasonable time frame, and reliance on natural attenuation alone would allow contaminants above aquifer cleanup levels to migrate an unacceptable distance of approximately 7,000 feet. Accordingly, neither Alternative 1 nor Alternative 2 is protective of human health and the environment and they will not result in the achievement of aquifer cleanup ARARs in a reasonable time frame. Moreover, Alternative 1 does not include monitoring or institutional controls to ensure protectiveness of human health and the environment; it is not protective and would not meet ARARs. Because neither alternative is protective or accomplishes EPA's remedial action objectives or ARARs in a reasonable time frame, neither is effective, and thus neither is cost-effective.
09.0	The CERCLA requirement that a selected remedy be cost-effective requires a comparison of both cost to effectiveness of each alternative and in relation to each of the alternatives. EPA's preferred alternative does not satisfy even the first cost-effectiveness test -- that the relative magnitude of cost be comparable to the effectiveness. EPA is proposing to spend $30 million to treat groundwater with a current highest TCE concentration of 32 ppb and which will naturally attenuate to below MCLs in 15 years or less. Thus, the effectiveness is small (because the harm is small) and the cost is high. That precludes a finding that EPA's preferred alternative is cost-effective.	The cost of EPA's selected remedy is comparable to its effectiveness. Extraction and treatment are employed at the contaminated area where MNA will not enable aquifer cleanup standards to be met within a reasonable timeframe and where migration of contaminants to uncontaminated areas would be excessive. The less expensive option of MNA is employed elsewhere. The remedy is cost-effective.
09.1	When comparing alternatives to one another, EPA must examine the incremental cost differences in relation to incremental differences in effectiveness. "[I]f the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist." EPA synthesized this to mean where two alternatives are comparably effective, the least costly alternative is the "cost-effective" alternative. As discussed above, natural attenuation is comparably effective to EPA's preferred alternative and either natural attenuation alternative is a small fraction of the cost. Therefore, only Alternative No. 1 or 2 is cost-effective for SIBW. The selection of any other remedy by EPA would be arbitrary and capricious, rendering the selected remedy invalid and unenforceable.	See response to IMC Magnetics Corp-Mr. Jenkins' Comments No. 08.0 and 09.0. Because Alternatives 1 and 2 would not be effective in achieving EPA's remedial action objectives in a reasonable timeframe, they are not an adequately effective remedy for the central and eastern contaminated areas. The selected remedy is cost-effective, and is not arbitrary, capricious, invalid, or unenforceable.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
10.0	EPA has indicated that it is not ready to identify those entities which EPA believes to be potentially responsible parties ("PRPs") for SIBW groundwater. EPA has nevertheless moved forward with the FS and Proposed Plan and is about to select a final remedy for SIBW. This is contrary to the statutory directive in CERCLA to identify and notify PRPs as early as possible before selection of a response action. Such an approach forces entities like IMC to guess whether EPA will consider them responsible for any of the SIBW remedial action, and effectively forces them to review all EPA actions at the site and submit comments thereon in order to preserve its rights to challenge EPA's action. Although there may be additional opportunities to discuss this with EPA, IMC wants to make it clear now that the data do not indicate that IMC contributed to the groundwater contamination, and that even if it had contributed, IMC could not have liability for any response actions related to the western plume.	EPA identified PRPs for groundwater contamination and issued general notices of potential liability to the majority of those PRPs, including IMC Magnetics Corp., in December 1997. (The remaining general notice was issued in January 1998.) The majority of those PRPs receiving general notices in December and January 1997 had received at least one general notice letter previously. EPA's procedure for identifying and notifying groundwater PRPs was not out of the ordinary and was consistent within legal requirements and guidance. EPA ensured that groundwater PRPs received time even beyond the already extended public comment period to review and comment on the RI/FS and the Proposed Plan. A number of PRPs did so, including this commentor. The evidence supports IMC's liability for groundwater contamination at IBW-South, and EPA will address its arguments, as appropriate, in the enforcement context.
11.0	Even if, arguendo, IMC has contributed to groundwater contamination in the central plume, it can have no liability for the western plume. The central plume is separate and distinct from the western and eastern plumes. The contaminants in the western plume are from a separate source or sources, the chemical fingerprint in the eastern plume is distinct, and a flow vector analysis indicates that groundwater in the central and western plume areas do not mix. Consequently, there has been no commingling of contaminants above MCLs from the central and western plumes. Thus, the resulting harm is divisible. In such circumstances, even a PRP who may have liability at some portion of the site has no liability for a geographically distinct plume to which the PRP did not contribute any hazardous substances. IMC did not contribute any hazardous substances to the western plume and accordingly cannot be held liable for any response costs associated with that plume, even under CERCLA's strict liability standards. IMC can be "held liable only for the response costs relating to that portion of the harm to which they contributed."	EPA has not determined whether the areas of contamination are separate and distinct. Further data analysis is needed to resolve this issue. The scope of IMC's liability for contamination at IBW-South is more appropriately addressed in the enforcement context rather than in this remedy selection document.
12.0	EPA has done nothing to control costs and promote cost-effectiveness. EPA is proposing a $30-$40 million remedy for a site that does not require active remediation.	EPA disagrees and has acted, based on recent modeling and data, to select a cost-effective remedy for IBW-South. EPA's remedy is expected to cost approximately $22 million. Active remediation is required at the site in order to accomplish remedial action objectives at the western contaminated area. Please see response to IMC's Magnetics Corp-Mr. Jenkins' Comments No. 08.0, 09.0, and 09.1.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
12.1	EPA's risk assessment is anything but "grounded in reality." The risk assessment: (1) uses maximum historical concentrations to characterize exposure over a time period where concentrations are known to have decreased and will continue to decrease, such that MCLs for TCE will be met in less than 15 years in the western and central plumes; (2) postulates a residential use exposure point for an area (the plume areas) where groundwater is not currently used as potable supply, cannot be reasonably assumed to be a future supply, and in which existing, enforceable institutional controls are already in place to restrict use; (3) improperly considered the existing data, which provide clear evidence of active biodegradation of TCE in the Western plume, the only area where TCE concentrations are great enough to observe related catabolic breakdown products; and (4) has relied on a groundwater flow model which fails to incorporate the effects of biodegradation, among others, which is not calibrated with water quality data, and which fails to show agreement with temporal trends in water quality data.	Maximum historical concentrations were not used in the risk assessment. EPA guidance (RAGS Part A) states that current groundwater concentrations can be used to represent future concentrations in groundwater, assuming steady-state conditions. The risk assessment acknowledges that groundwater contaminant concentrations fluctuate over time, leading to fluctuations in risk over time. There is no basis to assume that the groundwater resource under consideration will not be used sometime in the future as a potable water supply. Consideration of this potential future exposure is consistent with the NCP, which views groundwater as an inherently valuable natural resource to be protected and restored. Concerning potential residential use and potential future use of groundwater from IBW-South as a drinking water, see response to IMC Magnetics-Mr. Jenkins' Comment No. 02.0. Concerning occurrence of biodegradation at IBW-South, the rate of biodegradation is too slow and the occurrence of biodegradation is too localized, as discussed in the RI, to effect remediation of the western contaminated area within a reasonable time frame. The risk assessment did not improperly use the data from the RI, with its limited indication that localized natural attenuation of VOC contamination is occurring. Regarding item 4: the risk assessment did not use any results from the groundwater flow model. Responses to comments regarding the groundwater flow model have been provided elsewhere, however the risk assessment did not depend on any results of the groundwater flow modeling.
12.2	EPA has aggregated the central and eastern plumes with the western plume when even EPA's analysis, which grossly overstates the predicted risk, shows no need for action in the central and eastern plume areas and therefore warrants partial delisting.	EPA has not determined whether the areas of contamination are separate and distinct. Further data analysis is warranted before that determination is made. EPA's risk assessment does not grossly overstate site risks; contamination at IBW-South was and is significantly above MCLs and other aquifer cleanup standards. In some areas, contaminant concentrations appear to fluctuate rather than just decrease over time. The aquifer contaminants are continuing to migrate, and the aquifer has not been restored to and maintained at drinking water levels; therefore, remedial action, particularly monitored natural attenuation, is necessary in the central and eastern contaminated areas. Under these circumstances, delisting of portions of the IBW-South site is inappropriate.
12.3	EPA is being vague about whom it believes to be PRPs and has combined the central and eastern plumes with the western plume for purposes of remedial action. This forces parties to assume considerable transaction costs responding to an improperly prepared RI/FS and Proposed Plan in order to protect their ability to challenge being named as a PRP by EPA at a later time. This could hardly be characterized as increasing fairness.	Please see response to IMC Magnetics Corp-Mr. Jenkins' Comment No. 10.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by C.R. Jenkins

No.	Comment	Response
12.4	EPA is for some reason trying to hurriedly complete the remedy selection process to the point where the State of Arizona was forced to demand additional time to review and comment on the RI/FS and Proposed Plan. Such tactics cannot be considered to "ensure that states and communities stay more informed and involved in cleanup decisions."	EPA's efforts to complete the remedy selection process for the VOCs in groundwater at IBW-South are not "tactics" but simply appropriate efforts by the Agency to do its job in a timely fashion. EPA has amply involved the state and community, and EPA provided the State with well over the number of days it is required to give for the state's review of the RI/FS and Proposed Plan. In addition, the comment period was significantly extended, and the State has been extensively involved in the remedy selection process. The State and community have not raised these concerns.
13.0	All proposed cleanup actions are to be reviewed by the Board where (1) the estimated cost of the preferred alternative exceeds $30 million, or (2) the preferred alternative costs more than $10 million and that cost is 50% greater than that of the least costly ARAR compliant alternative. The cost of the preferred remedy is sufficiently close to $30 million to require Board review. EPA's cost estimate of $28.3 million is subject to significant uncertainty, and the outer bound of the cost range described by EPA's estimate is in excess of $42 million. Moreover, as demonstrated above, when the data are properly considered, natural attenuation is ARAR compliant and its cost is less than 50% of the preferred remedy. For that reason as well Board review is required.	The cost of the selected remedy is approximately $22 million, and need not be reviewed by the Remedy Review Board, which has jurisdiction over remedies expected to cost over $30 million. The Board also considers remedies over $10 million if the cost is 50% greater than the least costly ARARs-compliant alternative. Because MNA alone would not reach MCL ARARs within a reasonable timeframe, there is no less costly alternative that is ARARs-compliant, and review by the Board is unnecessary.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
1-01.0	According to the Public Notice, EPA states that the risk assessment conducted as part of the FS "concluded that it is necessary to conduct a cleanup action. VOC contaminated groundwater is not currently used as a drinking water source. Therefore, the risk assessment estimated potential future risks to residents through future residential use of VOC contaminated groundwater." The risk assessment given in the FS does not conclude that a cleanup action is required. Indeed, the risk assessment given in the FS was not used by EPA. EPA instead selected MCLs for the cleanup objectives.	EPA's risk assessment supports taking remedial action at the site, given the site risks disclosed in the risk assessment. Remedial action is also warranted where, as here, contaminant levels in groundwater exceed MCLs, non-zero MCLGs, or other chemical-specific ARARs. Please see response to IMC Magnetics Corp-Mr. Jenkins' Comment No. 01.0.
1-01.1	The risk assessment fails to address future risk even if groundwater from the SIBW is used in the future. The risk assessment is based on historical maximum concentrations, and not predicted future concentrations. That is, the risk assessment fails to include the abundant evidence that VOC concentrations are in fact decreasing at a rate such that the MCLs for trichloroethylene will be met in less than 15 years in both the Central and Western Areas.	The data used to estimate the potential for risk from groundwater exposure represent a snapshot of concentration trends taken over time. Information regarding the trends was incorporated by presenting the time series plots showing the ILCR versus sample date. This information shows that the risks trend both up and down over time, and no steady decline in risk is evident. Further, there are no definitive methods available that allow quantification of degradation rates for mixtures of chemicals. At best, degradation rates for individual chemicals could be considered, but degradation rates for chemical mixtures have not been quantified. The uncertainty associated with quantifying the potential for contaminant degradation would preclude useful interpretation of the results. Additionally, EPA's modeling indicates that the western contaminant area TCE will not reach the MCL level in 15 years; thus, extraction and treatment are warranted.
1-01.2	The risk assessment does not address separately the contaminated "plumes" defined by EPA in the FS and the Public Notice.	There is no certainty that the plumes are separate from each other because of the absence of monitoring wells between them. EPA has not made such a determination. In any event, the risk assessment need not evaluate areas of contamination separately.
1-02.0	EPA states "the risk assessment was performed with the assumption that exposure to VOC contaminated groundwater was possible at any location throughout the groundwater plumes even though groundwater in the vicinity of the IBW South plumes is not currently used as a drinking water source." The assumption made in the FS that exposure to VOC contamination is possible at any and every location within the SIBW is unjustified and unreasonable.	The risk assessment states that groundwater could be used sometime in the future for potable water, and this is the context in which the results should be viewed. The assumption made in the FS that exposure to VOC contamination is possible sometime in the future is reasonable and justified, as there is no reason to believe that groundwater will not be used at some time in the future at any given location, given the state classification of the aquifer as a drinking water source, the desire of the City of Tempe to be able to rely on this groundwater for domestic supply in emergencies, and the decline in water supply in the western United States. The point estimates of risk recognize that there is an equal probability of exposure at any given point in the area of contamination at some time in the future.
1-02.1	It is demonstrated herein that EPA has not reasonably demonstrated a public health risk and consequently has not demonstrated a need for extraction and treatment of groundwater for the protection of public health.	See response to IMC Magnetics Corp-Mr. Jenkins' Comments No. 01.0 and 04.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
1-03.0	EPA states "the proposed cleanup remedy for groundwater will address the VOC contamination in order to protect human health by minimizing future exposure to contaminated groundwater through treatment, continued monitoring, and restricting use of contaminated groundwater until the cleanup goals are met." The proposed cleanup remedy is not necessary to protect human health. Based on existing data, and a realistic groundwater model, it is predicted that natural attenuation, including biodegradation, is occurring at a rate that will result in MCLs being achieved by year 2006 in the Central Area and by year 2011 in the Western Area.	EPA's modeling shows that without some groundwater extraction in the western plume, the contaminant area above MCLs will migrate at least 7,000 feet downgradient and will not be restored to MCLs or other aquifer cleanup levels within a reasonable time frame. The extraction and treatment are necessary to protect human health and the environment where, as here, groundwater extends MCLs. EPA's selected remedy incorporates monitored natural attenuation in the central and eastern contaminated areas, where some remedial action is necessary, particularly monitoring of the natural attenuation processes.
1-03.1	EPA's rejection of biodegradation as a component of natural attenuation is based on an inadequate and superficial analysis of existing data. A more thorough analysis of existing data shows that biodegradation of TCE is in fact occurring in the Central and Western Areas.	See response to IMC Magnetics Corp-Mr. Jenkins' Comments No. 07.0 and 01.0.
1-03.2	The proposed cleanup alternative (Alternative 4) will not expedite the reduction of VOC concentrations to MCLs in a time significantly less than the time achieved by natural attenuation.	The revised modeling evaluation indicates that the area of contaminated groundwater above MCLs will migrate 7,000 feet downgradient and will not be restored to MCLs within a reasonable time frame. (See the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998.) EPA's modeling showed that MCLs would not be met in well over 50 years without extraction and treatment in the western contaminant area. Cleanup levels can be met in approximately 30 years with extraction and treatment. MNA should result in restoration of the central and eastern areas to MCLs within a reasonable time frame and thus is selected to remediate the central and eastern plumes (with a contingency in case it proves insufficiently effective).
1-04.0	MCLs will be achieved by way of natural attenuation in a time much less than 100 years and at a cost much less than a remedy that includes pump-and-treat. Public health will also be protected by natural attenuation because there are no immediate plans to use the groundwater as a municipal water supply and TCE will be below MCLs long before the groundwater is used for municipal purposes. In the meantime, the use of groundwater in the SIBW can be effectively controlled and restricted by existing laws and regulations that are currently in force and are being enforced.	EPA intends to rely on the existing laws and regulations for institutional controls, as well as notices to well applicants and potentially other actions, but they are insufficient alone to be protective and to meet ARARs. EPA's selected remedy does incorporate monitored natural attenuation in some parts of the site. One hundred years is not considered a reasonable time frame for remediation of IBW-South; the reasonable time frame is discussed in Chapter 10 of this ROD for IBW-South.
1-05.0	EPA's groundwater model is inadequate and too poorly structured to evaluate either the transport of contaminants or the groundwater dynamics necessary for a proper evaluation of remedial alternatives including no action and monitored natural attenuation. Deficiencies in EPA's groundwater model render the model inadequate and inappropriate to evaluate groundwater remedies.	Additional documentation of the model has been provided in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. This memo also presents the additional data that were incorporated into the evaluation. The models used are properly constructed and are not inadequate.

No.	Comment	Response
1-05.1	EPA's model unjustifiably ignores many factors that significantly effect the movement of groundwater and the fate and transport of contaminants. In particular, EPA's transport model ignores biodegradation of VOCs, the influence of flow in the Salt River, the effect of proposed projects such as the Town Lake and groundwater recharge. Furthermore, EPA fails to calibrate their model with observed water quality data and fails to show agreement of predicted concentrations with observed concentrations. The EPA model, as developed, cannot be used to predict meaningful spatial and temporal distributions of VOC contamination.	See response to IMC Magnetics Corp-Mr. Jenkins' Comment No. 07.0 regarding the significance of the biodegradation process at the site. The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional discussion of why a transient groundwater flow model was not appropriate for the evaluation, and how the effects of Town Lake and groundwater recharge were incorporated into the evaluation. On the basis of that information, it is clear that EPA's model can be used to predict meaningful spatial and temporal distributions of VOC contamination.
1-06.0	EPA states that the no action "alternative is not protective of public health and the environment because VOC contaminants above MCLs would remain in the groundwater and could migrate to affect other areas of the UAU and MAU aquifers; and without restriction on groundwater use the public could be exposed to contaminated water. Natural attenuation processes may occur, but it is not likely that contaminant levels would decrease to meet MCLs within a reasonable time period of 100 years, and without monitoring there would be no way to determine if MCLs would be met." Remediation by natural attenuation is protective of public health in virtue of the fact that groundwater is not used currently for municipal purposes, and there are no plans for such use within the foreseeable future. Concentrations of TCE will be reduced to the MCL within SIBW by 2006 in the Central Area and before 2011 in the Western Area. Furthermore, TCE concentrations above the MCL has not, and will not, occur outside of the SIBW as a result of VOC transport through groundwater from the Central Area.	The No-Action Alternative is not the same as monitored natural attenuation. With the No-Action Alternative, there is no monitoring to ensure protectiveness, and there are no institutional controls to protect the public from exposure to contaminated groundwater. Neither remediation by monitored natural attenuation nor the No-Action Alternative will remediate the western contaminant area within a reasonable time frame according to EPA's modeling, and neither alternative will prevent migration of contaminants a significant distance of 7,000 feet to uncontaminated groundwater resources.
1-06.1	It is relevant that EPA does believe natural attenuation will result in MCLs being met within a reasonable time frame, except in the western area of contamination (see FS, Table 8-2). However, this conclusion reached in the FS is contradicted in the Public Notice.	Although EPA now believes based on new data and updated modeling that monitored natural attenuation will enable restoration of the central and eastern contaminant areas, but not the western area, within a reasonable time frame, EPA did not, at the time of the Proposed Plan or the FS, believe that monitored natural attenuation alone would limit migration of these contaminated areas to less than 2,000 feet or result in their restoration within a reasonable time frame.
1-07.0	It is true that EPA has not demonstrated the biological breakdown of VOCs by microorganisms. However, EPA's assessment of the potential for biodegradation of TCE and other VOCs is inadequate. Proper evaluation of groundwater quality data does indeed demonstrate that biodegradation is occurring. Additional data collected recently by Dames & Moore for IMC gives direct evidence of the presence of anaerobic TCE degradation processes in groundwater. These data show that conditions in groundwater are conducive to microbial degradation of TCE and that significant microbial activity exists in the groundwater.	See response to IMC Magnetics Corp-Mr. Jenkins' Comment No. 07.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
1-07.1	The existence of active biodegradation of TCE in groundwater in SIBW is clearly indicated by data known to EPA and additional confirming data obtained by IMC and reported here for the first time. Yet EPA was predisposed to conclude in the FS and the Public Notice that biodegradation is not a component of natural attenuation in groundwater at SIBW. EPA used a simplistic screening level analysis without due attention to their own data to arrive at their conclusion that biodegradation is not an active mechanism in SIBW. This is a fatal flaw in EPA's evaluation of Alternatives 1 and 2 presented in the Public Notice. Had EPA made an objective analysis of their own data and had additional pertinent information regarding microbiological activity in groundwater been obtained, their conclusion would have been better informed and much different.	EPA rejects the commentor's unfounded assertion that EPA "was predisposed to conclude" any particular outcome in the FS and Proposed Plan. See response to IMC Magnetics Corp-Mr. Jenkins' Comment No. 07.0.
1-08.0	The Central and Eastern Areas are distinguished on the basis of different contaminants: TCE and PCE, respectively. TCE concentrations in the Western Area are significantly greater than TCE concentrations in the Central Area. TCE concentrations outside of the Central Area will not rise above the MCL (5 ppb) as a result of TCE within the Central Area. The Western and Central Areas are further distinguished by different parent:daughter ratios which suggest that the Western Area contamination is the oldest. Groundwater flow vectors from the IMC plant site are presented in the RI. These groundwater flow vectors within the UAU are shown on Figure 1 relative to the Eastern, Central and Western Areas. It is clear from the succession of flow vectors that the groundwater in the Central Area does not mix with groundwater in either the Western Area or the Eastern Area. This conclusion is also supported by the difference in major cation and anion proportions between groundwaters of the Central and Western Areas. The flow path from the IMC plant site does not intersect contamination within the Eastern and Western Areas. Contaminants in the Eastern and Western areas clearly do not originate from IMC. From the above considerations, it is concluded that the Central and Western and Eastern Areas are separate and distinct.	EPA has not determined that the contaminated areas are separate and distinct; further data analysis is warranted. The boundaries of the contaminated areas have been estimated based on data gathered from existing monitoring wells. An insufficient number of wells were located between estimated plume boundaries to establish that contamination was not connected or had not commingled.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
1-09.0	EPA has not identified a source of the TCE in the Central Area UAU. EPA implies only that the source is in the vicinity of IMC Magnetics Corp. IMC does not appear to be the source of TCE observed in the Central Area UAU. The TCE concentrations observed at well SIBW-19U are decidedly not indicative of a nearby source. Furthermore, TCA has never been observed in groundwater at SIBW-19U, 20U, 21U, and 22U, notwithstanding the fact that TCA has been observed in soil-gas at concentrations of similar magnitude as TCE. If IMC were a source of TCE, TCA should have been observed along with TCE. It has not. From the above considerations, it is concluded that IMC is not the source of TCE contamination in the Central Area UAU.	EPA has identified the operations of the IMC Magnetics Corp as the source of contamination in the central area of contamination at IBW-South, and EPA does not agree with the conclusion stated in this comment. EPA will address, as necessary, IMC's comment in the enforcement context.
2-1.0	Extrapolation of the upper branch of the 95 percent prediction interval reaches the MCL after a time lapse of 100 months. Therefore, it may be concluded with a confidence of 97.5 percent that any measurement of TCE concentration after 2001 will be less than 5 ppb within the Central Area monitor well complex.	The recent data presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models" support this comment. EPA's selected remedy has incorporated these new data.
2-2.0	TCE concentrations in the MAU within the Central Area are characterized by data from SIBW-15MB and SIBW-16MB. TCE concentrations at SIBW-15MB have been less than 5 ppb since the inception of the data set in June, 1991 through February 1996. TCE concentrations at SIBW-16MB have fluctuated between 3 ppb and 9 ppb, with an average of 5.6 ppb over the period of record from October 1991 to June 1996. TCE concentration in the MAU at SIBW-17MB and COT#7, immediately east of the Central Area have been consistently less than the MCL throughout the period of record for each well. Further east, beneath and east of the Eastern (UAU) Area, TCE concentration in the MAU increase to values that have exceeded the MCL. Thus, it is concluded that TCE observed in the MAU east of the Central Area is not due to TCE in the Central (UAU) area. Possible sources of the TCE in the MAU east of the Central Area are the degradation of PCE within the UAU of the Eastern Area or a surface source of TCE in the Eastern Area.	EPA has not determined whether the contaminated areas are separate or commingled. Further data analysis is warranted. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 1-08.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
3-1.0	EPA conducted a screening level analysis to evaluate the potential for biodegradation of TCE as an effective component of remediation by natural attenuation (RNA). EPA concluded that "inadequate evidence exists to suggest that biodegradation is actively remediating the western TCE plume near the DCE circuits facility". EPA indicates that data for eight out of 21 analyses required for their screening process were not available. Therefore, the screening process used to evaluate the potential for biodegradation was based on a data set that is only 62 percent complete. An evaluation based on a data set that is 38 percent incomplete is unacceptable. Data for application to CERCLA sites should be at least 80 percent complete.	The screening was performed with available data. Some evidence exists for biodegradation of TCE in the western contaminated area. However, the rate of biodegradation is not fast enough to remediate the aquifer before significant migration occurs. See response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 07.0. The groundwater movement is the more dominant process in the western contaminant area, and without some amount of groundwater extraction, the area of contamination above MCLs will migrate 7,000 feet and will not be restored to MCLs within a reasonable time frame. Data will continue to be collected to document and verify natural attenuation processes during RD/RA.
3-1.1	The biodegradation products cis-1,2-DCE and 1,1-DCE were observed by EPA in groundwater in the Western Area. EPA assumed that the "degradation of TCE to these daughter products occurred in the vadose zone, not in groundwater." EPA's rationale for this assumption is that cis-1,2-DCE and 1,1-DCE "were detected at high levels in soil-gas samples collected at source sites." EPA's reasoning is not supported by the data. In fact cis-1,2-DCE is not reported at all in tables of soil-gas data in Section 4.0 of the RI. Furthermore, cis-1,2-DCE is not an analyte listed for analysis in soil-gas samples specified in Tables 3 and 4 of the "Field and Analytical Methods, South Indian Bend Wash Site, Tempe, Arizona" (EPA 1992). In other words, cis-1,2-DCE was not analyzed in soil-gas samples reported in the RI. Even if cis-1,2-DCE were present in soil gas, a very elaborate analysis would be required to show that cis-1,2-DCE originated in the vadose zone and not in groundwater. Hence soil-gas data cannot be used to reveal the source of cis-1,2-DCE in groundwater at SIBW. EPA's soil-gas data indicate that TCE and PCE are the predominant halogenated VOCs in soil gas in the vicinity of DCE circuits in the Western Area. It is pertinent to note, furthermore, that 1,1-DCE is reported in only 8 out of 40 soil-gas sample collected near DCE circuits. Only one of these soil-gas samples contained 1,1-DCE concentrations above 1 µg/L. In the single soil-gas sample (S56) in which the 1,1-DCE concentration (7.26 µg/l) exceeded 1 µg/1, the TCE concentration was 31.9 µg/L. Yet 1,1-DCE was not detected above 0.5 µg/l in other soil-gas samples in which TCE was found at concentrations exceeding several thousand µg/L. Among the eight samples where 1,1-DCE was found, the concentrations of 1,1-DCE and TCA (1,1,1trichloroethane) are significantly correlated ($r = 0.73$; P-value = 0.04) whereas 1,1-DCE and TCE concentrations are not correlated. These results are consistent with the well known fact that 1,1DCE is a product of abiotic degradation of TCA and not of TCE degradation (Figure 12). It is concluded that EPA's rejection of biodegradation as a component of natural attenuation is not supported by the data.	See response to previous comment. EPA stated in the FS that biodegradation is a component of natural attenuation at IBW-South; however, it is not the dominant process at the site.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
3-2.0	Direct and useful evidence for evaluating the potential for RNA of TCE is the direct measurement of known catabolic intermediates. As such, the following TCE catabolites are commonly found in anaerobic aquifers impacted by TCE: cis-1,2-DCE, vinyl chloride, chloroethane, and ultimately, carbon dioxide and methane. In an aquifer environment, a molecule of TCE can partake of a number of catabolic pathways and associate with an unknown number of physiochemical processes such as attenuation factors, microbial assimilation, etc. Hence, even under enhanced or accelerated in situ bioremediation conditions where the generation of these metabolites would be most rapid and extensive, it is rare to detect cis-1,2-DCE at concentrations exceeding ca. 20-30 percent of the TCE concentration. AT SIBW~OU, both TCE and cis-1,2-DCE concentrations fluctuate slightly but do not exhibit temporal trends. At SIBW-28U, TCE concentration increases over time, whereas cis-1,2-DCE concentrations remain essentially unchanged. These results suggest the possibility of another source of TCE in the central part of the Western Area. To summarize, it is concluded that RNA involving biodegradation of TCE is occurring in the Western Area. Since the general water quality and hydrogeologic conditions are similar in the Central Area, it is concluded further that RNA involving biodegradation of TCE is occurring in the Central Area.	Some biodegradation may be occurring in the central area along with dilution and dispersion. EPA is recommending monitored natural attenuation for the central contaminant area. See response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 3-1.0
3-3.0	The evidence is very strong that biodegradation of TCE is occurring within groundwater of the Western Area. The existing data are inadequate for a similar evaluation of biodegradation in the Central Area. This inadequacy is due primarily to the low concentrations of TCE and the contaminant low concentrations of byproducts of TCE degradation. However, biodegradation within groundwater of the Central Area is probable, based on similar groundwater conditions in the Central and Western Areas.	See response to IMC Magnetics Corp-Mr. Hudson's Comment No. 3-2.0.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
3-4.0	Site specific evidence is presented in Appendix A for the potential of in situ bioremediation of TCE in groundwater in the Central Area. Total culturable heterotrophic bacterial plate count data showed that groundwater samples from wells SIBW-20U and SIBW-21U contained more culturable aerobic and anaerobic microbes than groundwater samples collected from wells SIBW-19U and 22U. However, it must be recognized that culturable, heterotrophic bacteria recovered from groundwater samples and tested under laboratory conditions reflect a portion of the indigenous microflora, but very likely do not represent the activity of the entire microbial community (biofilms, non-bacterial populations, community interactions, etc.). The presence of TCE in the aerobic test systems exhibited an inhibitory effect on all strains. Similarly, TCA was inhibitory to bacterial growth of all strains tested. This is also a reasonable finding in that TCA is not present in groundwater at this location. Hence, neither the aerobic nor the anaerobic microflora have had pressure to adapt to the presence of TCA. Conversely, strains were shown to be very active in the presence of TCE under anaerobic incubation conditions. For the purpose of comparing these data with those observed at related sites, growth readings in the presence of TCE under anaerobic conditions were ranked as "good" by Dr. Bruce Hemming of Microbe Inotech Laboratories, Inc. (St. Louis, MO). This ranking considers the activity of over 1,000 strains collected over a period of six years from hundreds of impacted sites in an effort to evaluate the potential of microorganisms to biodegrade related compounds. In the case of the anaerobic growth on TCE, and activity ranking of "good" or better has been observed in only 15% of the strains tested. The microbiological data obtained from analysis of groundwater samples show that biological degraders of TCE are in the groundwater of the Central Area and that biodegradation is an important component of RNA. Based on the analysis of existing data and the new data presented here, it is concluded that RNA, including biodegradation of TCE, is occurring within the Central and Western Areas of SIBW.	See response to IMC Magnetics Corp-Mr. Hudson's Comment No. 3-2.0.
4-1.0	The modeling study conducted by EPA is based on assumptions that lead to overpredictions of contaminant concentrations. The conservative assumptions used are not justified by the field data. In particular, neglecting degradation, transverse and vertical dispersion, and historical concentration data all lead to over-prediction of future concentrations. In addition, extraction and injection scenarios appear to be non-optimal; transient features affecting flow patterns were neglected (flows in the Salt River); and future features affecting flow were ignored (development of Town Lake). This kind of modeling approach is typically used in a screening level study, but not in designing remedial schemes. The consequence of layering simplistic, conservative assumptions is that an unnecessarily aggressive remedial alternative is selected.	See responses to Unitog Comments No. 05-1 and 31-1, and to ADEQ Comments No. 1.01 and 2.01. EPA does not agree that an unnecessarily aggressive remedial alternative has been selected.

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4-1.1	Comment re: Page E-1, Section E.1, para 1, line 1 of the FS: The model calibration description should be expanded. The calibration approach is briefly described, but calibration results, validity of model, and descriptive or statistical measures of model fit to reality are not provided.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration.
4-1.2	Comment re: Page E-1, Section E.1, para 1, lines 5 and 6 of the FS: Model time-history concentration matching should be performed in order to estimate reliable cleanup times and distances. In other words, extrapolation from a single point is uncertain, whereas extrapolation from several points on a time graph has more validity. No time history concentration matching was performed.	Steady-state groundwater flow conditions were used to evaluate a range of groundwater flow scenarios. A transient groundwater flow model was not warranted for the FS. The time-history concentration matching referred to by the commentor requires a transient flow and solute transport model. EPA had specific modeling objectives for the FS, and the steady-state flow and transport model was appropriate given the objective.
4-2.0	Comment re: Page E-2, Section E.2.1, para 1 of the FS: Other key elements of the conceptual model should include groundwater recharge and discharge over space and time. The conceptual model description does not, but should, include analysis of data deficiencies, potential sources of error in the conceptual model, and consequential uncertainties in model-based conclusions.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration, sinks and sources, data limitations, and uncertainties.
4-2.1	Comment re: Page E-4, Section E.2. 1, 1st bullet of the FS, which states "The fluid being modeled is incompressible." This assumption is incorrect and should be restated: The fluid being modeled is compressible but density changes due to compression are neglected.	Comment is noted, however the FS has not been modified.
4-2.2	Comment re: Page E-6, Section E.2.3, bullets of the FS: Model selection should be revised and based on commonly-accepted guidelines (i.e. selection based on a model's ability to simulate site conditions and meet project goals, demonstrated validity and field testing, peer review and public availability). According to EPA's "Compilation of Ground-water Models" MICROFEM has limited verification and unknown peer review of coding (EPA, 1993). CHEMPATH is not listed.	EPA believes that MicroFem and Chempath were appropriate models to use for the IBW-South Groundwater FS. Both models have been used on other EPA sites and have been approved by EPA for use on those sites. EPA has provided additional information regarding these models in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998.
4-2.3	Comment re: Page E-6, Section E.2.4.1, 1st para of the FS: A map is needed to show property distributions supplied to the model.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding distribution of properties.

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4-2.4	Comment re: Page E-8, Section E.2.4.2 of the FS: This section appears to present steady-state boundary conditions for historical flow conditions. Since the transport model is based on a steady flow pattern, it appears that important boundary conditions have been neglected. For example, transient river flows affecting past plume trajectories, and the potential development of Town Lake affecting future plume trajectories should be considered. In addition, the use of supplied head boundary conditions around most of the UAU constrain the model solution. Model results are likely to underestimate the drawdown and capture of wells in a model so constrained.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration and boundary conditions. Steady-state groundwater flow conditions were used to evaluate contaminant movement due to a representative flow condition. The development of Town Lake will not significantly affect plume movement, as described in Section 7 of the RI.
4-3.0	Comment re: Page E-8, Section E.3 of the FS: The groundwater flow model calibration should be presented graphically, and the fit should be quantified between predicted and observed data. In the absence of this information no confidence can be placed in the flow model predictions. No comparisons between predicted and observed heads or groundwater fluxes were presented. If fluxes were not used to test the model then the calibration is non-unique; if infiltration rates and hydraulic conductivities in the model are doubled, then an identical prediction will be produced, but the implications for plume travel and capture zones will be different. In addition, no verification of the model was presented. If alternative boundary conditions or stresses were tested (e.g. simulate one of the pump tests and compare modeled and field data) then perhaps the model could be shown to be valid.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration.
4-3.1	Comment re: Page E-13, Figure E-5 of the FS: It appears that the placement of the containment wells is non-optimal. One or two wells at the downgradient end of the plume would, working with groundwater gradient, contain the heart of the plume equally well with less pumping. It appears that cleanup duration may have affected containment design, but this is not mentioned. In addition, the effect of Town Lake on optimal placement of containment wells should be evaluated.	See response to IMC Magnetics Corp-Mr. Hudson's Comment No. 4-3.2.
4-3.2	Comment re: Page E-16, Figure E-7 of the FS: Extraction wells outside the target areas will cause contamination to be transported to clean parts of the aquifer. The placement of the Alternative 5 extraction wells appears to be non-optimal.	The well locations were selected taking into account streets and other open parcels. The actual well locations will be revised during remedial design. Moving the well location does not affect the evaluation of the alternative.

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4-4.0	Comment re: Section E.5 of the FS: The concentrations in the cleanup wells should be predicted and presented for each alternative along with the pumping rates. At pumping rates of 200 to 1,000 gpm, both clean and contaminated water will be drawn to the wells and the overall concentrations are likely to be significantly lower than the concentrations currently observed. Consequently, the extracted water may be at concentrations too low to require treatment.	The influent concentrations will most likely be low. The influent concentrations will be estimated during remedial design to support design of the treatment system. Since one of the remedial alternative objectives is hydraulic containment, it is likely that some clean water will be drawn to some extraction wells. However, because groundwater generally exceeds MCLs in the areas where groundwater will be extracted, it is likely that extracted groundwater will require treatment before being discharged.
4-4.1	Comment re: Page E-22, Section E.6.2 of the FS: A new, apparently not widely tested, model has been used in EPA's analyses. The model has been applied without calibration to field data. Instead, current or recent concentration data were used as starting conditions and input transport parameters were assumed (not shown) to transport the plumes into the future. In fact, if the small-adsorption and no-decay assumptions listed here are used to develop the plume historically, then a plume larger than the model domain is produced. It seems that the transport assumptions used here are overly conservative and have resulted in inaccurate over-estimates about the duration and level of future concentrations. This in turn, leads to the selection of unnecessarily aggressive remedial alternatives. No demonstration has been presented that the model predictions match observed data or can replicate the observed evolution of the plume. Consequently, no confidence can be placed in the predictions. In addition, no sensitivity analyses have been performed for uncertain input parameters. Consequently the level of uncertainty in the predictions is unknown.	See response to IMC Magnetics Corp-Mr. Hudson's Comment No. 4-2.2 regarding the model selection. The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model approach. EPA's selected remedy is not overly conservative or aggressive. See response to your Comment No. 4-1.2.
4-4.2	A screening model was used to evaluate RNA of the Central and Western TCE plumes. The model used, BIOSCREEN, is distributed by the EPA and was developed for AFCEE with cooperation from the EPA. Calibration of the model without including biodegradation was also attempted. Several parameters were changed in attempting to calibrate the model to observed conditions. These parameters include: initial source concentration, source mass, time, and retardation. The model could not be calibrated to match observed concentrations in both time and space. Although a scenario can be developed to predict a good fit to recent observed data, the agreement between observed historical data and the model predictions would be poor. Additionally, although the model can be adjusted to match well with data over time at one location, the predictions for the rest of the plume would not agree with the observed concentrations.	These model results presented by IMC Magnetics Corporation estimate that the downgradient extent of the Western MCL plume moves approximately 3,600 to 4,200 feet to the south before groundwater concentrations decline to 5 ppb. These conclusions are similar to the conclusions of the EPA model that the MCL plume migrates more than 2,000 feet.

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4-6.0	The calibrated BIOSCREEN model was applied to predict the concentrations along the center line of the Central Area for a period of 25 years beginning in 1986. The output of the BIOSCREEN model for the Central Area predicts that the maximum TCE concentration will reach the MCL of 5 ppb by the year 2006. EPA's risk assessment is based on the tacit assumption that a hypothetical drinking water well moves along with the maximum concentration and that the maximum concentration does not change over time. As noted above, the predicted TCE concentration in such a well will fall below 5 ppb by the year 2006. A more reasonable measure of health risk is the 30-year average TCE concentration at a fixed point within the Central Area. The worst-case point for installing a drinking water well for future use is approximated by the current location of the maximum TCE concentration along the center line. This point is approximately the location of the maximum concentration in 1996, i.e. a point 2,820 feet downgradient from SIBW-21U. The 30-year average TCE concentration in this hypothetical well is 3.4 ppb. Thus a time-average TCE concentration for a hypothetical new well placed at any location in the central area will be less than 3.4 ppb over a 30-year period. TCE concentrations were also predicted with BIOSCREEN over a period of 30 years at hypothetical wells at Apache Boulevard and at Broadway Road, along the Central Area center line. At the hypothetical well at Apache Road, the 30-year average TCE concentration is predicted to be 2.4 ppb. At Broadway Road, the 30-year average TCE concentration is predicted to be 1.0 ppb. It is concluded that VOC contamination presently in the Central Area will not contribute significantly to groundwater contamination outside of the current boundary of the Central Area and, more particularly, outside of the boundaries of the SIBW.	The groundwater model presented by the commentor is also associated with numerous assumptions and uncertainties and represents an alternative approach to evaluating and interpreting the existing groundwater data. The appropriateness of the definitive statement declaring a groundwater contaminant concentration in a well in the year 2006 is questionable in light of the uncertainties associated with the model used, and, indeed, with any model. See response to previous comment. The risk assessment model used to estimate the potential risks related to exposure to groundwater contaminants was also used as a means to interpret the existing groundwater condition. EPA guidance (RAGS part A) states that current groundwater concentrations can be used to represent future concentrations in groundwater assuming steady-state conditions. The risk assessment acknowledges that groundwater contaminant concentrations fluctuate over time, leading to fluctuations in risk over time. Recent data from the central contaminant area support the last sentence of this comment.

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5-1.0	The City of Tempe does not currently rely on groundwater production wells for municipal water supply. With the exception of a three-week period in 1992, the city has not used its municipal supply wells since 1990 and has not depended on groundwater as part of its municipal water supply since the early to mid-1980s. The City of Tempe now obtains all of its water from the Salt River Project (SRP) and the Central Arizona Project (CAP), and is the only city in the Phoenix metropolitan area that does not use groundwater for municipal supply.	Restrictions on access to groundwater and other institutional controls may appropriately be considered in evaluating the effectiveness of a particular remedial alternative. Such restrictions are not, however, a substitute for more active response measures that actually reduce, minimize, or eliminate contamination (unless such measures are not practicable, as determined by the remedy selection criteria). EPA has rejected recommendations to encourage the use of institutional controls in lieu of active remediation measures, consistent with Congress's preference for treatment and permanent remedies (as opposed to prevention of exposure through legal controls), as set forth in CERCLA Section 121(b)(1). The thrust of this comment is that remedial decisions should be based only upon current uses of the groundwater (or lack thereof). EPA disagrees. It is EPA policy to consider the beneficial use of the water and to protect against current and future exposures. Groundwater is a valuable resource and should be protected and restored if practicable. EPA's remedial action objectives are consistent with the NCP's expectation that groundwater be restored to its beneficial uses, and that expectation has been appropriately considered in making site-specific determinations for IBW-South on the maximum extent to which permanent solutions and treatment can be practicably used in a cost-effective manner. The RAOs include cost-effectively reducing groundwater contamination to concentrations meeting aquifer restoration levels to return groundwater to its beneficial use as a source of drinking water within a reasonable time under the circumstances at the site. The assumption that groundwater at IBW-South could be used as a drinking water is a reasonable, realistic one, and it highlights the necessity of restoring groundwater to its beneficial uses. The aquifers at IBW-South are classified by the State of Arizona as potential sources of drinking water. There are extraction wells at IBW-South that were formerly used to extract groundwater used as drinking water supply. The City of Tempe has expressed the wish that the groundwater be restored, and may rely upon that groundwater in emergency circumstances (particularly given the limited water supply in the American west and proposed future development for the City of Tempe). Thus, groundwater at IBW-South may be used as a drinking water supply in the future; and, for these same reasons, the restrictions on access to groundwater do not eliminate the groundwater exposure pathway for future users or for users who might install a private well. Remedial action is generally warranted where, as at IBW-South, groundwater exceeds MCLs, non-zero MCLGs, or other chemical-specific ARARs. In sum, the fact that the City of Tempe is not, or may not be likely to, use groundwater as

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		drinking water, or serve water exceeding MCLs to its residents, has no significant bearing on the necessity of restoration given the potential use of groundwater as a drinking water and the foregoing discussion.
5-2.0	The City of Tempe has already submitted an application for an assured water supply designation to ADWR for review, in anticipation of the December 31, 2000 deadline. Issuance of an assured water supply designation to the city is reported to be imminent (COT, 1997) . The demonstration of assured water supply presented in the application is reported to be based solely on the availability of SRP and CAP water, and does not rely on groundwater from the city's municipal supply wells (COT, 1997). The impending issuance of an assured water supply designation based solely on surface water sources makes it unlikely that the City of Tempe will ever use their municipal supply wells, other than during drought or unanticipated interruption in surface water deliveries. According to the SMP for the Phoenix AMA (1990-2000), the water management goal of the AMA is to reach safe-yield by the year 2025 or earlier (ADWR, 1991). The Groundwater Code defines safe-yield as "to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial groundwater recharge in the active management area" (A.R.S. §45-561.7). Although the SMP states that safe-yield does not mean that no groundwater may be pumped, achievement of safe-yield clearly requires a reduction in groundwater pumpage. This water conservation requirement [Phoenix AMA Municipal Water Conservation Requirements], in conjunction with the fact that the City of Tempe's service area is surrounded by other municipalities and cannot expand, makes it even less likely that the city will need to rely on groundwater for its future water needs. Potable water systems are regulated by ADEQ (A.R.S. §49-351 through 360). The City of Tempe's water system is classified as a public water system, and is regulated under the Safe Drinking Water Act (SDWA). Although the City of Tempe does not currently pump groundwater, if the city were to resume pumping groundwater for municipal water supply, drinking water quality regulations would not allow the city to deliver water containing concentrations of organic or inorganic constituents in excess of maximum contaminant levels (MCLs).	See Response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 5-1.0.

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5-3.0	The City of Tempe and SRP have rights to withdraw groundwater within their respective service areas for the purpose of delivering water to their municipal and agricultural customers. If a person does not have a groundwater right and wishes to withdraw groundwater from a nonexempt well (capable of pumping greater than 35 gallons per minute and 10 acre-feet per year), that person must obtain a groundwater withdrawal permit from ADWR. Of the eight categories of groundwater withdrawal permits, future groundwater withdrawal permits within the SIBW would likely fall into one of the following four permit categories: PQGWWP, temporary electrical generation, temporary dewatering, or hydrologic testing. Of the four categories, only dewatering permits require that the water be put to beneficial use. Therefore, only groundwater produced under a dewatering permit could potentially be used for human consumption, although it is unlikely that the water would be used for such a purpose.	See Response to IMC Magnetics-Mr. Hudson's Comment No. 5-1.0.
5-4.0	The well construction rules administered by ADWR (A.A.C. R12-801 through 822) establish minimum standards for well construction in Arizona. The well construction standards were designed to ensure that wells are constructed and abandoned in a manner that will protect against contamination of the aquifer from the land surface, and cross-contamination of the aquifer from migration of poor quality groundwater down the well annulus. The most specific reference to groundwater contamination in the well construction rules is in A.A.C. R12-812.B, which states that "in all water-bearing geologic units containing mineralized or polluted water as indicated by available data, the borehole shall be cased and grouted so that contamination of the overlying or underlying groundwater zones will not occur." It should be noted that the well construction rules were developed to protect groundwater from becoming contaminated as a result of poor well construction. There is nothing in the well construction rules that precludes the installation of a well in an area due to the presence of contaminated groundwater.	ADWR has the authority to impose restrictions on placement of wells or require modifications to such wells installed in contaminated groundwater pursuant to its groundwater withdrawal, permitting, and well spacing and impact authorities. In order to further protect the public from exposure to contaminated groundwater, notices will be distributed by ADWR, Arizona Department of Health Services, or EPA concerning risks from exposure to contaminated groundwater. See also response to IMC Magnetics-Mr. Hudson's Comment No. 5-1.0.

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5-5.0	In 1997, the Arizona State Legislature passed new legislation that extensively changed the statutes relating to the Water Quality Assurance Revolving Fund (WQARF), legislation that has been referred to as "WQARF Reform". As part of WQARF Reform, ADWR is now authorized to inspect wells for vertical cross-contamination of groundwater by hazardous substances and to seek cooperation from the well owner in modifying or abandoning a well that is causing cross-contamination (A.R.S. §45-605). ADWR is also required to perform a water quality review of all Notices of Intention (NOIs) to drill production wells. Specifically, ADWR will review a NOI to ensure that the construction of a proposed well will not contribute to vertical cross-contamination of groundwater. In other words, if there is groundwater contamination in the upper alluvial unit (UAU), ADWR will ensure that the proposed construction provides for the UAU to be sealed off from the middle and lower units to prevent contamination of the productive portion of the aquifer. The new law does not give ADWR the authority to deny a permit to drill a well on this basis.	See Response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 5-4.0.
5-5.1	A.R.S. §36-601.A provides for intervention by the Arizona Department of Health Services (ADHS) in cases where public health is endangered. The statute is sometimes referred to as the "endangerment statute", and covers a broad range of public health hazards. The statute can only be invoked in cases of extreme, imminent danger to public health, however, and has never been applied to groundwater contamination. Application of this statute to prevent someone from installing a well in an area of known groundwater contamination (ADHS, 1997) has not been tested.	Comment noted. See Response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 5-4.0.

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5-5.2	A review of existing groundwater production wells and current uses of groundwater within the SIBW indicates that the only entities known to be currently pumping groundwater within the SIBW are SRP, APS, and possibly one or more owners of smaller industrial or domestic wells. The City of Tempe does not currently rely on groundwater for part of its municipal water supply. The only wells that may currently be pumping groundwater for human consumption, therefore, are smaller industrial/ domestic wells. As noted previously, all existing industrial/ domestic wells are located upgradient or offgradient of any known sources of groundwater contamination within the SIBW. Institutional constraints on future uses of groundwater within the SIBW are summarized as follows: · ADWR Assured Water Supply Requirements. Under the Groundwater Management Code, all municipalities within the Phoenix AMA are required to demonstrate an assured water supply. The City of Tempe has applied for and is in the process of obtaining an assured water supply designation without including its municipal supply wells as part of its demonstration. · Phoenix AMA Management goal. The water management goal of the Phoenix AMA is to reach safe-yield by the year 2025 or earlier. Although this does not mean that no groundwater may be pumped, achievement of safe yield clearly requires a reduction in groundwater pumpage. · Phoenix AMA Municipal Water Conservation Requirements. Under the SMP for the Phoenix AMA, the City of Tempe has entered into the NPCCP and has agreed to implement water conservation measures. · Regulation of Potable Water Systems. Drinking water quality regulations will not allow the City of Tempe to deliver water containing concentrations of organic or inorganic constituents in excess of maximum contaminant levels (MCLs). · Groundwater Withdrawal Permits. Future groundwater withdrawal permits may include PQGWWP, temporary electrical generation, temporary dewatering, or hydrologic testing permits. Only groundwater produced under a dewatering permit could potentially be used for human consumption. · ADWR Well Construction Rules. ADWR well construction rules establish minimum standards for well construction in Arizona, and were developed to protect groundwater from becoming contaminated as a result of poor well construction. There is nothing in the well construction rules that precludes the installation of a well in an area due to the presence of contaminated groundwater.	See responses to IMC Magnetics Corp.-Mr. Hudson's Comments No. 5-1.0 and 5-4.0.

· ADWR Well Spacing and Well Impact Rules. ADWR well spacing and well impact rules allow ADWR to reject a permit application for a well with a designed pumping capacity greater than 500 gpm if it is determined that operation of the well would cause the migration of poor quality groundwater.

· WQARF Reform Legislation. As part of WQARF Reform, ADWR is now required to perform a water quality review of all NOIs to ensure that the construction of a proposed well will not contribute to vertical cross-contamination of groundwater. The new law gives ADWR the authority to require an applicant to modify the design of a proposed well, but not the authority to deny a permit to drill the well.

· Public Health Statutes. The "endangerment statute" (A.R.S. §36 601.A) provides for intervention by ADHS in cases where public health is endangered, but can only be invoked in cases of extreme, imminent danger to public health. This statute has not been tested as a means of preventing someone from installing a well in an area of known groundwater contamination.

The results of this analysis indicate that there is little or no potential for contaminated groundwater within the SIBW to be used as a future source of drinking water. The City of Tempe does not currently use groundwater for municipal water supply and is unlikely to do so in the future, except during drought conditions or unplanned interruptions in surface water deliveries. If the City of Tempe were to resume pumping groundwater for municipal water supply, drinking water quality regulations would not allow the city to deliver water containing concentrations of organic or inorganic constituents in excess of maximum contaminant levels (MCLs). Groundwater pumped from wells owned by SRP is not used for drinking water.

It is possible that groundwater from existing industrial/ domestic wells within the SIBW is currently being used for human consumption. Because all of the wells are located upgradient or offgradient of any known sources of groundwater contamination, however, it is unlikely that the wells have been or will be impacted by groundwater contamination from the SIBW.

Although existing regulations protect groundwater from becoming contaminated as a result of poor well construction, there is currently no regulation that would prevent a landowner from installing an exempt well (capacity less than 35 gpm and 10 acre-feet per year) on private property in or downgradient of an area of contaminated groundwater and using the water for domestic supply, provided that the well serves less than 25 people and is therefore an unregulated drinking water system. Because the SIBW lies within the service area of the City of Tempe, the probability is small of someone constructing a well

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	for such a purpose.	
6-1.0	Comments re: Section 4.1.1 of the FS: *"The primary purpose of a baseline risk assessment is to provide risk managers with an* understanding of the actual and potential risks to human health and the environment posed by a site and any uncertainties associated with the assessment. This information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action." The risk assessment does not fulfill any of the purposes stated in the above quotation. The risk assessment does not satisfy EPA's stated purpose for the risk assessment.	EPA disagrees with this comment. EPA's risk assessment for IBW-South has accomplished its stated purpose and has clarified the actual and potential risks to human health posed by the site, as summarized in Chapter 7 of the ROD. The risk assessment acknowledges uncertainties associated within it. The information the risk assessment provides is useful in determining the current and potential threat to human health, as summarized in Chapter 7 of the ROD, and whether it warrants remedial action. Given the site risks presented in the risk assessment, remedial action is warranted, in view of the potential for use of groundwater as a source of drinking water and the inadequacy of institutional controls to protect from installation of individual groundwater wells for extracting water for domestic use. If residents are exposed to TCE and PCE in groundwater, the potential for increased cancer risks and non-cancer health effects exists. Action is warranted under EPA's risk assessment for that reason. Remedial action also is warranted if groundwater exceeds MCLs, non-zero MCLGs, or other chemical-specific ARARs. At IBW-South, groundwater exceeds those standards, necessitating remedial action.
6-1.1	Not only is there no current risk associated with VOC contamination in the SIBW, it is less than remotely possible that a significant risk will develop in the future as a result of public consumption of the groundwater from either the UAU, MAU, or LAU. If the risk assessment is taken at face value, without considering the above noted faults, the predicted incremental risks to hypothetical domestic water users do not exceed 10-4 (cumulative cancer risk). Therefore, the conclusion that "if untreated groundwater at current concentrations were used for drinking or showering, health risks above unacceptable levels would exist" (FS, page 4-18) is not justified. Further, rather than relying on the risk assessment results, EPA selected MCLs for cleanup goals. The lack of any apparent connection between the risk assessment and the feasibility study is unexplained and is clearly inconsistent with the intended application of risk assessment in the CERCLA process.	EPA disagrees with the commentor's claim that there is no current or future risk associated with VOC contamination at IBW-South. As the risk assessment and Section 7 of this ROD show, there are future risks associated with the VOCs in groundwater, including TCE, PCE, benzene, and 1,2-dibromoethane. The risk assessment also delineated areas where TCE and PCE were detected at concentrations posing risks greater than 1 x 10-4. If residents were exposed to TCE and PCE in groundwater, the potential for increased cancer risks exists, as properly shown by the risk assessment and FS. See response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 12.1.
6-2.0	EPA's risk assessment failed to recognize the important and very relevant fact that TCE and other VOC concentrations are decreasing rapidly. Rather, EPA based their risk assessment on VOC concentration data for the UAU collected between January 1994 and February 1996. This approach is based on the erroneous assumption that future exposure to VOCs in groundwater is represented by past conditions. In fact, using EPA's methodology, the risk to hypothetical users of the groundwater would be less than one/one million.	See the response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 12.1.

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6-2.1	Domestic water use was the only exposure scenario considered in the risk assessment, "regardless of the constraints on groundwater use or reasonable consideration of the pathways of exposure" (FS, page 4-1). No rationale was given for the selection of this currently non-existent use and improbable future use. Such an undefended hypothetical construct cannot be used as a rational basis for remedial decision making.	See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 5-1.0.
6-2.2	In order to estimate exposure to receptor populations, it is necessary to define representative concentrations of site-related chemicals in potential exposure media. The "sample-specific" assignment of exposure point concentrations and calculation of associated "risk" used in EPA's risk assessment is rationalized as an attempt to retain the spatial definition of data that is lost when classical summary statistics are used (FS, pages A-17, A-18). The implicit assumption is that each individual sample represents an equally valid representation of a chronic residential drinking water supply. However, by assigning equal weight to all samples, this approach fails to account for either temporal variability in exposure (due to temporal trends in concentration) or the fact that a drinking water well, if such were ever drilled in this area, would necessarily combine water drawn from a more extensive volume than represented by any individual monitoring well. A more appropriate way to capture spatial and temporal definition of data, if this should be necessary, would be to evaluate the historical sampling results for each well as representative concentrations, and estimate potential receptor exposure on the basis of (1) likelihood of the hypothetical exposure scenario, (2) projected concentrations in drinking water wells placed at specified locations, and (3) expected changes in concentrations over time.	EPA guidance (RAGS Part A) states that it should generally be assumed that water could be drawn from anywhere in the aquifer, regardless of the location of existing wells relative to the contaminant plume. Temporal or spatial variability in contaminant concentrations in groundwater could potentially result in either an overstatement or understatement of health risks depending upon the actual distribution of contamination. The "refinements" suggested by the commentor would not significantly improve the characterization of the uncertainties in either temporal and spatial variability, or result in a defensible "reduction" in estimated risks. Determining the "likelihood of the hypothetical exposure scenario" or selection of hypothetical residential well locations would require judgements that do not account for the desire to preserve the groundwater resource for future use or the necessity of restoring groundwater to MCLs or other chemical-specific ARARs. As set forth in EPA's response to IMC Magnetic Corp-Mr. Jenkins' Comment No. 5-1.0, future use of groundwater is a reasonable potential exposure pathway under baseline conditions.
6-3.0	A total of 27 VOCs out of 56 analyzed were considered to be chemicals of potential concern (COPCs) in the monitoring wells. Twenty-one VOCs were never detected, and five more were eliminated "because they were detected in only one or two samples (FS, pages A-6, A-7). Extending this valid logic of eliminating chemicals with low detection frequency, another eleven chemicals could also be dismissed on the basis of infrequent detection.	Any additional chemicals that could be dismissed from the risk assessment do not significantly influence the resulting risk estimates. Excluding additional chemicals detected relatively infrequently in groundwater would not change the results from the risk assessment, or influence the remedial action decision.
6-3.1	Another inconsistency arises with 1,2-dibromoethane and benzene, both of which are determined not to be COPCs (FS, pages A-23 - A-29). As mentioned previously, 1,2-dibromoethane can be eliminated due to low detection frequency alone. EPA finally concludes that TCE and PCE are the only chemicals of concern (COCs). However, despite their elimination as COPCs, EPA appears to retain 1,2-dibromoethane and benzene as COCs for characterizing risk.	Benzene and 1,2-dibromoethane were included to provide an upper bound on estimated site risks. While infrequently detected, these chemicals were included in the risk assessment based on considerations of potential toxicity. Benzene is a known human carcinogen, while 1,2-dibromoethane is a potent animal carcinogen, and considered to be a probable human carcinogen. Accordingly, they were appropriately included. Risks associated with more prevalent TCE and PCE contaminants were generally in the 1 x 10-4 to 1 x 10-6 range. The risk assessment also delineated areas where concentrations of TCE and PCE, the more widespread contaminants, were detected at concentrations posing risks higher than 1 x 10-4.

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6-3.2	Sample results from all aquifers were stratified by EPA according to calculated total incremental cancer risk. In Table A-9 (FS, page A-20), 18/352 values (5.1%) exceed the regulatory threshold of 10-4. Excluding the non-COPC 1,2-dibromoethane, the number of samples exceeding this threshold was reduced to 6, or 1.7% of the samples (FS, page A-28). However, the number exceeding the threshold after removal of 1,2-dibromoethane should apparently be 5, not 6 (FS, Table A-14, page A-28), which shows 13 samples whose total risk dropped below 10-4 without this chemical. It is also not clear why the total number of samples excluding 1,2-dibromoethane (362) is listed as greater than the total number of samples including this compound (352) in (FS, Table A-15). There appears to be a typographic error in the "10-6 - 10-7" category. Thus the percent of total samples with incremental cancer risk greater than 10-4 is actually 5/352 or 1.4 percent, at this stage of EPA's analysis. Five samples are eliminated from the > 10-4 category when the non-COPC benzene is eliminated (FS, Table A-16, page A-29). According to Table A-17 (FS, page A-30), these samples were all from well SIBW-42U, and thus do not overlap with any of the samples in which 1,2-dibromoethane's elimination in a total incremental cancer risk of <10-4 (FS, Table A-14, page A-28). Therefore, when both non-COPCs 1,2-dibromoethane and benzene are eliminated from consideration, an obvious step that was not taken in the risk assessment, there are no samples remaining in the >10-4 category. Given this result and the fact that groundwater is not being used and very probably will not be used for human consumption in the foreseeable future, there is no rationale for invoking groundwater remediation.	There is no reason to believe that groundwater will not be used at some time in the future as a potable water supply. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 5-1.0. The risk assessment characterized risks from benzene and 1,2-dibromoethane separately from the chlorinated VOCs to show the differences in risks between relatively higher toxicity but lesser frequently detected contaminants and the more prevalent contaminants such as TCE and PCE. While most risks estimated for contaminants in groundwater fell in the 1 x 10-4 to 1 x 10-6 risk range, the risk assessment delineated areas where concentrations of TCE and PCE, the more widespread contaminants, were detected at concentrations posing risks higher than 1 x 10-4. There is ample basis for, and indeed, the necessity of, remedial action at IBW-South. See response to IMC Magnetics Corp.-Mr. Hudson's Comments No. 6-1.0 and 5-1.0. Risks due to TCE and PCE exposure fall within the risk range of 1x10-4 and 1x10-6, and action may be warranted when contamination falls within this range. If residents were exposed to TCE and PCE in groundwater through drinking water or household uses, the potential for increased cancer risks and noncancer health effects exists. Action is warranted because contamination exceeds MCLs and other chemical-specific ARARs; and action is consistent with the NCP expectation that the aquifer, which is classified as a potential source of drinking water, be restored to meet drinking water standards. Because the IBW-South aquifers are actual or potential sources of drinking water, active treatment is warranted to return those sources to their beneficial use. Moreover, without active treatment, the aquifer restoration goals would not be met within a reasonable time frame, and contaminants at levels above regulatory levels would migrate an unacceptable distance.
6-4.0	EPA's risk assessment did not consider the variability of VOC concentrations in space and time. It is possible to incorporate the average of TCE concentrations over an appropriate time for the Central and Western Areas. This has already been accomplished in effect in Section 4.2.3 using the BIOSCREEN model calibrated to observed TCE concentrations. The 30-year averages are consistent with EPA's usual assumption that exposures in a residential setting occur for 30 years. Notwithstanding the inapplicability of EPA's risk assessment, it is of interest to apply the intake factors developed by EPA for the SIBW risk assessment to the 30-year concentrations in Tables 4 and 5.	If modeling is not used, EPA guidance states that current groundwater concentrations can be used to represent future concentrations assuming steady-state conditions. While this can create uncertainties in potential risks associated with contaminants in groundwater, reliance on modeling, particularly if model selection is inappropriate, also creates uncertainties. Use of BIOSCREEN for estimating exposure concentrations in groundwater for TCE is questionable because it does not account for the formation of vinyl chloride, a known human carcinogen, resulting from TCE biodegradation. Use of available groundwater monitoring data to project future risks is not inconsistent with EPA risk assessment guidelines. Characterization of health risks acknowledges that future risks could be lower than risk estimates, based simply on dispersion and transport of groundwater contaminants.

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6-5.0	Assume that a hypothetical drinking water well was installed in 1996 at the point of maximum TCE concentrations in the Central UAU. From Table 4, the predicted 30-year average TCE concentration at this location is 3.4 ppb. Combined with EPA's intake factors, a TCE concentration of 3.4 ppb results in a calculated risk of 1 x 10-6 (to one significant figure). The risk predicted by EPA's methodology would be less than 1 x 10-6 for a future hypothetical drinking water well installed at any other location within the Central Area. Thus, even if groundwater from the Central Area were used for human consumption, the excess cancer risk from exposure to TCE would be well below EPA's own guideline for maximum acceptable risks. Active groundwater remediation should not be necessary for TCE contamination in the Central Area.	EPA disagrees with the use of 30-year average concentrations as calculated with BIOSCREEN. As discussed previously, BIOSCREEN is inappropriate for modeling chlorinated VOC fate and transport in groundwater because it neglects the formation of vinyl chloride in groundwater from TCE degradation. Remedial action is warranted. Please see responses to IMC Magnetics Corp.-Mr. Hudson's Comments No. 5-1.0 and 6-1.0. However, EPA agrees that active remedial action is not warranted in the central area of contamination and has selected monitored natural attenuation to restore that area (along with a contingency remedy should MNA prove insufficiently ineffective).
6-5.1	Assume that a hypothetical drinking water well will be installed in the year 2000 at the point of maximum concentration in the Western Area UAU. This location would be near Broadway Road at the center line of the Western Area. From Table 5, the predicted 30-year average TCE concentration at this location is 4.6 ppb. Combined with EPA's intake factors, a TCE concentration of 4.6 ppb would result in a calculated risk of 2 x 10-6 (to one significant figure). The predicted risk would be less than 2 x 10-6 for a hypothetical drinking water well installed in the year 2000 at any other location within the Western Area. In fact, the risk at almost all other locations would be less than 1 x 10-6. Thus, active groundwater remediation should not be necessary for TCE contamination in the Western Area.	EPA disagrees with the use of 30-year average concentrations as calculated with BIOSCREEN. As discussed previously, BIOSCREEN is inappropriate for modeling chlorinated VOC fate and transport in groundwater because it neglects the formation of vinyl chloride in groundwater from TCE degradation. Remedial action is warranted. Please see responses to IMC Magnetics Corp.-Mr. Hudson's Comments No. 5-1.0, 6-1.0, and 6-3.2. In the western area, contamination exceeds MCLs, and remedial action thus is warranted. Without active remedial action--extraction and treatment--modeling has shown that contamination would migrate over 7,000 feet, an unacceptable distance, before reaching MCLs. In addition, EPA modeling has shown that contaminant concentrations would not reach MCLs within a reasonable time frame of approximately 30 years without extraction and treatment in the western area of VOC contamination.

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6-5.2	Because there is no reasonable likelihood that groundwater from the SIBW will be withdrawn for human consumption within the next 15 years, there will be no significant risk to the public as a result of TCE in the groundwater. The TCE concentrations will degrade below MCLs within the next 15 years in both Central and Western Areas. Even if drinking water wells were installed in the Central Area now and in the Western Area in the year 2000 or later, the risk to the public would not be significant, i.e. the risk would be less than 1 x 10-6. The conclusion is that active groundwater remediation is not needed in either the Central or Western Area to protect the public health.	EPA conducted the Baseline Risk Assessment for IBW-South in accordance with CERCLA, the NCP, and relevant EPA guidance. The goal of the risk assessment was to perform an evaluation of potential risks associated with contaminated groundwater at IBW-South. To evaluate potential risks, EPA is required to evaluate the reasonable maximum exposure (RME) scenario, which is the "highest exposure that is reasonably expected to occur" under baseline conditions. Under baseline conditions, it is not appropriate to assume that institutional controls to limit access to contaminated groundwater exists. EPA's assumption that contaminated groundwater at IBW-South could be used as drinking water is reasonable. All groundwater at IBW-South is classified as a drinking water source by the State of Arizona. Municipal water supply wells currently exist at IBW-South and although they have not been used except for one time for emergency use since VOC contamination was detected at IBW-South; the City of Tempe has expressed its desire to be able to use municipal supply wells at and downgradient of IBW-South during future emergency drought situations. Therefore, under baseline conditions, human ingestion of contaminated groundwater is a realistic exposure pathway. Contamination levels in the western plume are at four to five times above the SDWA MCLs, which are considered health-based levels for ingestion of water. Therefore, active remediation is necessary in the western area of contamination. VOC concentrations are lower in the central and eastern areas of contamination, and therefore may pose lower risks from exposure. EPA has selected a less aggressive MNA cleanup remedy to address this area while setting criteria to protect future (COT) municipal wells from contaminant exposure, to ensure that contaminants do not migrate an unacceptable distance, and to ensure that aquifer cleanup levels are met within a reasonable time frame. Please see response to previous comment also.

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7-1.0	No discussion as to the desirability of treatability testing, either laboratory scale or field scale, is provided in the FS. The EPA guidance for conducting feasibility studies under CERCLA states, "Frequently, technologies have not been sufficiently demonstrated or characterization of the waste alone is insufficient to predict treatment performance or to estimate the size and cost of appropriate treatment units. Furthermore, some treatment processes are not sufficiently understood for performance to be predicted, even with a complete characterization of the wastes. For example, it is often difficult to predict biological toxicity in a biological treatment plant without pilot tests. When treatment performance is difficult to predict, an actual testing of the process may be the only means of obtaining the necessary data." The conclusions reached by EPA in the evaluation of the natural attenuation alternative failed to account for the uncertainty and lack of correlation between indicator parameters and actual performance. EPA should have recommended studies for evaluating the presence of biological activity and the kinetics of the natural attenuation process. With respect to the historical use of pump and treat technology, EPA has not sufficiently evaluated the technical uncertainty with respect to the effectiveness of aquifer restoration. On the basis of data and analysis provided herein, natural attenuation, with contribution from biological degradation, is acting effectively to remediate site groundwater. Initiation of groundwater recovery for treatment will not significantly change the time required to reduce contaminant levels to MCLs. The processes that are in action appear to be rate determining and concurrent initiation of a pump and treat system would only add excessively to the ultimate total project cost with no substantive benefit.	The technologies for remediation of the contaminants at IBW-South have been sufficiently demonstrated for many years. In particular, extraction and treatment has been effective in achieving significant gains toward aquifer restoration at many Superfund sites. Additionally, each of the three technologies that may be used to treat extracted groundwater, UV/Ox, LGAC, and air stripping with VGAC, is included in EPA's guidance discussing presumptive technologies. There was no necessity of addressing treatability testing in the FS. As shown in Appendix C of the FS, biological treatments were evaluated and found to be very limited. See response to IMC Magnetics-Mr. Jenkins' Comment No. 07.0. Although natural attenuation has not been evaluated at as many sites as extraction and treatment of groundwater, EPA does believe natural attenuation is occurring and has selected it as the most cost-effective alternative for certain areas of the IBW-South site. EPA also has adopted a contingency remedy of extraction and treatment of groundwater at those MNA areas if natural attenuation proves to be insufficiently effective. Site data and modeling indicate that natural attenuation is not occurring at a sufficient rate to be a protective, ARARs-compliant remedy for the western contaminant area.
7-1.1	The assembly of technologies and process options considered by EPA was very limited. This assembly should have included biological treatment as a remedial technology applicable under the treatment category of general response actions. As a result of this oversight, no additional discussion is presented in the FS which would allow for the development of biological process options, such as microbial anaerobic and aerobic degradation. Furthermore, this oversight precluded the development of specific remedial alternatives incorporating biological treatment alternatives such as biostimulation and/or bioaugmentation. The FS contains no discussion or justification as to why biological treatment was not included in the initial range of remedial technologies. The assembly of technologies and process options considered by EPA should but did not include in-situ well stripping or in-situ reactive walls as technologies under the treatment category of general response actions. Such technologies are emerging as efficient and cost-effective remedial alternatives.	As shown in Appendix C of the FS, biological treatments, except for bioreactors, were eliminated after the first step of the screening process. Figure C-1 shows the detailed evaluation of the first step. In the final step of the screening process, the treatments remaining from the first step "are evaluated in more detail against the criteria of effectiveness, implementability, and relative cost." The bioreactors were eliminated during this final step as shown in detail in Figure C-2. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 7-1.0. In-situ reactive walls may be emerging technologies, but not for sites at which depth to groundwater is 50 to 100 feet.

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7-2.0	Section 7.2.2, Alternative 2 - Natural Attenuation of the FS states, "..the plume will expand during the course of the natural attenuation process.". This statement is not substantiated. Groundwater transport modeling, which is documented herein, clearly indicates that the target volume of ground water which exceeds the MCL for the constituents of concern, PCE and TCE, is rapidly decreasing and eventually will be eliminated during the course of natural attenuation. Expansion of the plume target volume as a result of advective and dispersive mechanisms is a transient effect which is counterbalanced and eventually will be made inconsequential by the natural effects of biological degradation.	The term "expand" means, in this context, that the plume will migrate into areas that were previously not contaminated above MCLs. It was not intended to mean that the actual volume of contaminated groundwater above MCLs would increase. See response to IMC Magnetics Corp.-Mr. Hudson's Comments No. 7-1.0 and 7-1.1 and IMC Magnetics Corp.-Mr. Jenkins' Comment No. 07.0.
7-2.1	Table 7-2, Screening of Groundwater Alternatives in the FS states that the effectiveness of the natural attenuation alternative "..depends primarily on the rate of contaminant concentration reduction through physical, chemical, and biological processes." This statement is correct. However, the FS concludes that the rate of biological degradation in the groundwater is zero. Analysis of groundwater collected from the Central Area for biological activity, the results of which are documented and discussed in Section 3 herein, is in direct conflict with this statement. Furthermore there are ample data in the FS and RI that strongly suggest that biodegradation of TCE is occurring at a rate sufficiently rapid to result in the MCL being achieved within the Central and Western areas in a time period of 15 years or less.	The FS stated that the degradation rate for biological processes was not significant. With additional data evaluation, EPA stated, in a meeting with the groundwater stakeholders, that some limited biological degradation is occurring. The biological degradation rate cannot overcome the groundwater movement and prevent plume migration in order to meet remedial action objectives for the western area of VOC contamination. See response to IMC Magnetics Corp.-Mr. Hudson's Comments No. 7-1.0 and 7-1.1 and IMC Magnetics Corp.-Mr. Jenkins' Comment No. 07.0.
7-3.0	With respect to screening of the site, EPA used a screening process which weighs various analytical parameters and evaluates the evidence for natural attenuation (through biodegradation) by assignment of points. Table 8-1 of the FS shows the results of this screening. Several mistakes were made in the screening process. A minus three points for dissolved oxygen was assigned based on a single measurement of 3.5 mg/L. Dissolved oxygen results from monitoring well sampling and field measurements are unreliable unless they are conducted under rigorous sampling QA/QC protocols which minimize the introduction of atmospheric oxygen during the collection and testing period.	Even though dissolved oxygen was not routinely monitored, it was monitored using appropriate procedures at several wells during one sampling event. The results were consistent with other measurements in the region.
7-3.1	The screening process for the quantification of contaminant migration and natural attenuation was also flawed because no points were assigned for the presence of TCE based on the assumption that all detected TCE was historically released at the Site. However, PCE was also released at the Site and TCE is a daughter product of PCE. No apparent analysis of spatial distribution of TCE which could indicate PCE degradation was conducted.	The data set used for the screening is limited to the western contaminant area where significant PCE releases are not believed to have occurred. Monitored natural attenuation is a component of the selected remedy.

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No.	Comment	Response
7-3.2	Other detected daughter products were dismissed based on the opinion that no degradation was occurring in the groundwater and that all degradation had occurred in the vadose zone. This statement (FS, page 8-11) is unsubstantiated and totally conjectural. The dismissal of positive indicators of a mechanism due to an alternative unsupported hypothesis to explain their presence is a flaw in EPA's logic in the screening process for quantification of contaminant migration and natural attenuation.	The data set used for the screening is limited to the western contaminant area where significant PCE releases are not believed to have ocurred. Monitored natural attenuation is a component of the selected remedy. See response to ADEQ Comment No. 1.01.
7-3.3	No data were available to EPA, in its quantification of contaminant migration and natural attenuation efforts, for 8 of 21 of the parameters necessary for evaluating biodegradation. A zero score was assigned for each of the missing parameters. Since a high score favors biodegradation, the overall score is biased against biodegradation by the absence of data. Extrapolation of EPA's logic would lead one to conclude that if no parameters were evaluated, biodegradation would always be nonexistent. To summarize, the conclusions reached by EPA from the screening process are unsupportable and are contradicted by other, more direct evidence provided herein. The collection of additional site characterization data to support natural attenuation and the simulation of natural attenuation using fate and transport models that incorporate appropriate processes were not conducted as required in the referenced protocol for evaluation of natural attenuation.	As stated in section 8.3.2.1 of the Groundwater Feasibility Study, initial screening was performed to determine whether biodegradation has the potential to be a viable remedial alternative at IBW-South. The conclusion stated was that inadequate evidence exists to suggest that biodegradation is actively remediating the western TCE contaminant area. This conclusion was immediately followed by the statement that data were not available for eight of the analytes in the screening process. Nowhere did EPA state that natural attenuation was definitely not occurring at the site. The conclusion is supported by the data. EPA will continue to collect data for verification of natural attenuation processes including biodegradation at IBW-South. This will include verification of all possible natural attenuation processes, including biodegradation. This post-RI data collection does not contradict the steps presented in "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater" (Wiedemeier, et al., 1996). These steps are listed on page 8-7 and 8-8.

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7-4.0	In Table 8-2, of the FS, EPA states: "The time until preliminary cleanup goals are achieved through natural attenuation processes is estimated to be less than 30 to 50 years for all plumes except the western UAU plume which is likely to take more than 100 years to meet remedial objectives." In this statement, EPA admits in effect that MCLs will be achieved through natural attenuation in, by EPA's definition, a reasonable time period within the Eastern and Central Areas. Their assessment with regard to the time required to achieve MCLs in the Western Area is unsubstantiated and contradicted by other, more direct evidence presented herein.	For the western contaminant area, modeling performed during the FS and again after the issuance of the Proposed Plan, and documented in the August 12, 1998, Technical Memorandum "Documentation of Indian Bend Wash-South Groundwater Flow and Solute Transport Models," indicates that MCLs will not be met within a reasonable time frame of approximately 30 years without contaminants migrating a substantial distance from the current estimates of the extent of contamination. EPA has determined that 30 years, rather than 100 years, is a reasonable time for remediation based on time to remediate groundwater at other Superfund sites and modeling performed for IBW-South. Thus, through these modeling efforts and through evaluation of current groundwater modeling data, EPA does not expect that MNA alone will meet the remedial action objectives within this time frame at the western contaminant area. These modeling data have been presented and distributed to the commentor and are available in the Administrative Record. MNA is appropriate for the central and eastern areas of contamination based on EPA modeling, and EPA has established criteria to evaluate the MNA process in the central and eastern areas. If these criteria are exceeded, extraction and treatment will be necessary under the contingency remedy selected in this ROD. Groundwater monitoring data collected since issuance of the FS indicate that concentration levels have increased in some monitoring wells located at the downgradient edge of the contaminant areas. EPA has selected a remedy with a possible contingency remedy which will enable the remedial action objectives of meeting aquifer cleanup standards within a reasonable time frame of approximately 30 years, while also limiting the amount of contaminated groundwater migration in order to restore the aquifer to its beneficial use as a potential source of drinking water. EPA stands by its modeling results.
7-4.1	Table 8-2 of the FS summarizes the 5-year and 30-year present worth sums of the O&M and Capital cost for the natural attenuation alternative incorrectly as $28,300,000 and $13,950,000.	The present worth costs for Alternative 2 presented in Table 8-2 of the FS should be $1,370,000 for the 5-year and $2,580,000 for the 30-year present worth.

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7-4.2	In Section 9.1.3 of the FS EPA states: "The adequacy and reliability of natural attenuation to meet cleanup goals is more uncertain than Alternative 4 because less monitoring will be performed. " The physical and chemical mechanisms which contribute to the natural attenuation process are demonstrably effective in their ability to continuously, without interruption, decrease the concentration of site groundwater contaminants. These processes are irreversible; none of the physical or chemical processes concentrate or replenish site groundwater contaminants. The biological mechanisms which contribute to the natural attenuation process were not properly accounted for in the detailed evaluation of the alternatives and therefore were wrongly excluded from EPA's comparative analysis of alternatives.	Because of fluctuations in site conditions over time, it is not proven that natural attenuation continuously and without interruption decreases the concentration of groundwater VOC contamination. Natural attenuation depends on site conditions that may change. Factors that affect the ability of natural attenuation to effectively reduce contaminant concentrations include the biological and chemical degradability of the contaminants, the physical and chemical characteristics of the groundwater, and physical characteristics of the geological medium. EPA believes that natural attenuation is occurring and has selected it as a remedial option, but has adopted a contingency remedy should MNA prove insufficiently effective. See responses to IMC Magnetics Corp.-Mr. Hudson's Comments No. 7-2.1 and 7-3.3, and the response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 7-2.1, for a further discussion of biodegradation.
7-5.0	The effectiveness and permanence of any process is independent of observation. The mere act of monitoring any remedial process has absolutely no effect upon the process. Additional monitoring is simply a verification tool and should not be considered under the criteria of effectiveness or permanence.	For the effectiveness and permanence criteria, the alternatives were evaluated for magnitude of residual risk and adequacy and reliability of controls, not monitoring, as shown in detail in Table 8-2 of the FS. Monitoring, however, is essential for overseeing contaminant migration and the effectiveness and permanence of remedial processes. For example, monitoring is an essential tool for evaluating whether MNA is effectively reducing contaminant concentrations and maintaining that reduction, or whether the contingency remedy of extraction and treatment for a target volume in an MNA area is necessary.

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No.	Comment	Response
7-5.1	The FS contains no rationale for the placement of monitor wells for Alternatives 2, 4, 5 and 6. Monitoring of remedial activities should be optimized and justified in the discussion of each alternative.	The FS presented approximate or estimated locations for monitoring wells based on the estimated target volumes to be extracted under Alternatives 4, 5, and 6, or naturally attenuated under Alternative 2. Because the target volumes to be extracted and the contours of the contaminated areas to be monitored for natural attenuation were planned to be evaluated during remedial design, as indicated in the Proposed Plan, a detailed evaluation of the precise placements of monitoring wells was unnecessary, and might have been confusing, if included in the FS discussion of alternatives. EPA believes that monitoring of remedial activities should be cost-effective, and that placement of monitoring wells should take into account that goal, current site conditions, and other factors; such information can best be obtained and used during remedial design. The locations of the monitoring wells were selected to provide water quality data to monitor the progress of remediation under each alternative. Monitoring Well MW-1 was located to monitor for any continued migration of the western contaminant area, while Wells MW-2 and MW-3 were located to better define the western extent of that contaminant area. Monitoring Wells MW-4 and MW-5 were located to detect any future downgradient migration of the central and eastern areas of contamination, respectively. It should be noted that it is the intent of EPA to perform a more detailed evaluation of monitoring requirements and locations during the remedial design process.
7-5.2	Alternative 4 envisions the mere transference of site contaminants from groundwater onto a granular carbon bed. The FS contains the statement: "Under Alternatives 3, 4, 5, and 6, air stripping of groundwater followed by VGAC adsorption of contaminants in the offgas is an inherently irreversible treatment process as long as the carbon is disposed offsite." (FS, page 9-6). Alternative 4 would generate 66,000 pounds per year of contaminated spent carbon and the proposed alternative for management of this material is disposal. This material, by nature of the process involved, would concentrate contaminants. This would most likely lead to a medium which would contain contaminants in concentrations that would be toxic to any microbiological organisms making this an even less permanent solution. CERCLA 121(b) requires that permanent solutions be utilized to the maximum extent practical. Alternative 2 is more permanent than any of the treatment alternatives that simply transport site contaminants from one medium to another and from one site to another.	Vendors or contractors typically retrieve spent carbon containing VOCs and treat it to thermally destroy those contaminants. Therefore, the contaminants are permanently eliminated, not deposited elsewhere.
7-5.3	Section 9.1.4 of the FS contains the statement: "Under Alternative 1 and 2, no treatment processes are used.". This statement is misleading. The processes inherent to natural attenuation are operational in both Alternative 1 and 2 and these processes result in the reduction of the concentration and total mass of contaminants despite the absence of active intervention.	Natural attenuation processes are not generally considered "treatment" as that term is used in the NCP.

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Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
7-5.4	Table 9-1 of the FS contains a summary of comparative analysis of alternatives and presents a relative ranking of the six alternatives against the seven threshold and primary balancing criteria. The FS does not contain any explanation of the ranking methodology. In Table 9-1 of the FS, the alternatives fall in non-regular patterns between least to best performance on a comparison axis for each evaluation criterion. This manner of ranking alternatives suggests that a numerical weighting system was used. However, neither the weighting system nor the method of summing over the evaluation criteria is given in the FS. If the seven evaluation criteria are given weights and the alternatives are given scores for each criterion proportional to their position between "least" and "best" in Table 9-1, the following scores may be developed. The highest score represents the best alternative: Alternative 1 - 22 points Alternative 2 - 27 points Alternative 3 - 20 points Alternative 4 - 25 points Alternative 5 - 26 points Alternative 6 - 27 points Under this system, Alternatives 2 and 6 would be the best alternatives. This contradicts the EPA selection of Alternative 4 and indicates that some undescribed methodology was used to weight individual alternatives for each criteria and/or to weight individual criteria against one another. To summarize, EPA's ranking methodology is imprecise and does not support or logically lead to the relative ranking presented in the FS.	Throughout Section 9 of the FS, a detailed comparison of each alternative for each criterion is given; it is summarized in Table 9-1. This table does not represent a numerical weighting system, but a conceptualization of how each alternative compares to the other alternatives. In the table on page 10 of the Proposed Plan, EPA summarized the detailed comparison made in Chapter 9 of the FS, showing that Alternative 2 lacked compliance with four of the seven criteria. The Proposed Plan also shows that Alternatives 4, 5, and 6 are the alternatives meeting all the evaluation criteria, but Alternative 4 is the most cost-effective. EPA does not agree with the commentor's re-evaluation based on its numerical weighting system, and believes that the weighting system does not properly compare the alternatives or determine the one that represents the best balance in meeting the nine criteria. For example, while Alternatives 5 and 6 would expedite groundwater remediation, and are thus protective, they are not the most cost-effective and should not be at the top of the list as the "best" alternatives. Similarly, Alternative 2 is not one of the "best" alternatives because, as EPA modeling shows, it would not remediate the western contaminant area within a reasonable time frame and would allow the contaminants to migrate an unacceptable distance. EPA employed the method set forth in the NCP for analyzing and balancing the nine criteria in determining the preferred and selected alternative and the contingency remedy.
7-6.0	In Appendix D of the FS, EPA states that "These cost estimates are order of magnitude estimates and are expected to be accurate within +50 to -30 percent.". With this degree of accuracy, the cost estimates should be represented as ranges. For example, Alternative 1 should be represented as a total cost range over a 30 year period as $3,870,000 to $1,806,000 instead of a single value of $2,580,000. Similarly, Alternative 4 should be represented as a total cost range over a 30 year period as $42,450,000 to $19,810,000.	Having stated that these cost estimates are expected to be accurate within +50 to -30 percent, it is not necessary to present the cost estimates as a range. This accuracy range is in accordance with the NCP.
7-6.1	Attachment D-7 of Appendix D (Cost Evaluation in the FS) gives the predicted life expectancy of individual equipment components of the treatment systems which are used in Alternatives 3, 4, 5, and 6. These life expectancies appear to be excessively high. Replacement costs above and beyond regularly scheduled O&M should be incorporated into the cost estimates for the treatment alternatives. For equipment components which have less than a 30-year life expectancy, EPA makes no allowance for replacement in the 30-year cost estimates.	The life expectancies of the individual equipment are within the guidelines of standard cost engineering. The pumps are the only item with a life expectancy less than 30 years. Capital costs associated with the replacement of the pump(s) are only 1 percent or less of the 30-year present worth. Therefore, including this replacement cost does not significantly change the current costs presented in the FS.

Comments from IMC Magnetics Corporation

Dated 11/25/1997 by Timothy S. Hudson for Dames & Moore

No.	Comment	Response
7-6.2	The cost estimates in the FS indicate that an annual interest rate of 5 percent to account for inflation is used to calculate net present costs, however, no allowance for escalation in the price of specific equipment, materials, or services is included in the estimate. This omission could artificially lower the cost estimates for the treatment alternatives relative to Alternative 2 - Natural Attenuation.	According to the EPA REM IV Cost Estimating Guide, costs in future years should not be escalated to account for general price inflation, given the difficulty in forecasting relative price changes. As stated in the FS, the accuracy of the cost estimates is expected to be within +50 to -30 percent of the actual cost.
7-7.0	No evaluation of cost uncertainty of individual line items or components of the cost estimates is provided. Since the treatment alternatives contain a higher percentage of costs which are associated with equipment, goods and services subject to the effects of escalation, the overall uncertainty of the cost of the treatment alternatives could well be greater than the uncertainty of Alternative 2 - Natural Attenuation.	According to the EPA Rem IV Cost Estimating Guide, costs in future years should not be escalated to account for general price inflation, given the difficulty in forecasting relative price changes. All the alternatives have uncertainties, which are accounted for in the capital cost construction allowance and contingencies. As stated in the FS, the accuracy of the cost estimates is expected to be within +50 to -30 percent of the actual cost.
7-7.1	The cost of the alternatives is developed for comparison on a 5-year and 30-year present worth basis, yet no consideration is provided for the expected duration required for each alternative. The economic evaluation should include allowance for expected duration.	The economic evaluation does include an allowance for expected duration. The estimated aquifer cleanup times are significantly longer than 5 years and are presented in Section 9.0 of the FS under the "Reduction of Toxicity, Mobility, or Volume Through Treatment" criterion. The 5-year present worth cost was provided for supplemental information.

Comments from Las Estadas Homeowners Association

Dated 11/21/1997 by Steve Bauer

No.	Comment	Response
1	The Las Estadas Homeowners Association is an incorporated homeowner's association in Tempe, Arizona representing forty-four (44) homes with a gross value of more than $20 million. We are extremely concerned with the potential that treated effluent could be discharged into the Salt River Project's Tempe Canal No. 6. This canal directly effects the South Tempe Municipal Water Plant which provides the potable water for the south half of Tempe. Clearly, the EPA should not choose an alternative that will directly impact an uncontaminated drinking water supply. The other alternatives identified in your study are technically feasible and financially sound. Therefore, we ask that you eliminate the alternative of discharging treated water into the Salt River Project Canal No. 6 from any proposed remediation project for the South Indian Bend Wash Superfund Site.	EPA recognizes the residents' concerns about the SRP Canal end-use option and will take these concerns under consideration during the final end-use determination. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." Should EPA decide to discharge to Tempe Canal No. 6 after consideration of the points raised in this comment, the water discharged will be treated to health-based protective levels to eliminate risk, thereby protecting the public.

Comments from Prestige Cleaners, Inc., & Arizona Jacobson Co.

Dated 11/24/1997 by Bruce C. Travers, R.G., for EMCON

No.	Comment	Response
1.0	The objectives of the RI, as stated in the report, are to determine the location, nature and extent of soil, soil gas, and groundwater contamination in the vicinity of the SIBW area. The RI does a very poor job in describing and presenting the location, nature, and extent of soil, soils gas, and groundwater contamination. A better presentation of the historical data and water quality trends needs to be made. It is apparent by reviewing the data in Appendix K that degradation of some nature is occurring within the SIBW area. More attention needs to be paid to the cause and ultimate effects of the degradation process. The RI has improperly presented worst case data and does not appropriately illustrate the present and future water quality conditions.	EPA disagrees with the comment's characterization of the RI, and believes that the RI properly presents, in accordance with the NCP, the location, nature, and extent of contamination at IBW-South, including historical data and water quality trends, which are documented in the Administrative Record. The main focus of the RI is the groundwater. The Administrative Record has been updated with new data and modeling based on those new data. A more detailed evaluation of the soils and soil gas data was presented in the 1993 RI supporting the 1993 Soils ROD. Additional data collected on soils since that time has been summarized in the 1997 RI and in data available in the Administrative Record. The PPIs which are part of the RI Report and represent data at individual facilities will be updated with additional soils information, and/or subsite investigations will be presented in focused remedial investigation reports (FRIs). EPA believes the information in the RI on degradation and related natural attenuation processes is ample and supports the selected and contingency remedies. The RI looked at all data, not just worst-case data, and the Selected Remedy is based on that data and more recent data and modeling that reflect present and future water quality. Please see responses to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 07.0 and response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 3-1.0 concerning biodegradation.
1.1	Comment re: Page 1-30 of the RI. The RI report states that "DNAPLs may exist at IBW-South". What evidence has been collected to support this theory? The dissolved concentrations of VOC's in groundwater presented in Appendix K do not support the existence of DNAPLs.	DNAPLs may exist at any site where VOCs are present in groundwater. Because they may mobilize over a period of time, they cannot be ruled out. EPA agrees, however, that the concentrations of contaminants at IBW-South presented in the most recent data in the Administrative Record do not indicate that DNAPLs are likely to be present in significant quantities.
2.0	Comment re: Page 1-31 of the RI. The RI report states that "the driving forces of groundwater movement in the UAU at IBW-South are the significant downward vertical gradients, changes in groundwater flow directions, and high horizontal hydraulic gradients caused by flow events in the Salt River. The changes in groundwater recharge patterns caused by intermittent flow in the Salt River have significant implications for contaminant transport at IBW-South." What the RI fails to point out is that these factors also are responsible to a great degree for the rapid reduction in VOC concentrations in the aquifer. A review of the historical water quality data clearly demonstrated the rapid reduction in VOC concentrations in the aquifer due to these and other site conditions. Each time a flow event occurs, a large recharge event occurs which further dilutes and disperses the VOC concentrations. The high horizontal conductivity creates a larger dispersion coefficient, resulting in "Natural Attenuation" to reduce VOC concentrations. Fluctuations in groundwater levels, though not presented in the RI, can and do allow additional dilution of VOC concentrations within the aquifer.	The RI adequately addresses the impact of site conditions on contaminant concentrations; such conditions support the reliance on MNA in the selected remedy for certain contaminant areas. Please see response to Prestige Cleaners & Arizona Jacobson Co.'s Comment No. 1.0.

Comments from Prestige Cleaners, Inc., & Arizona Jacobson Co.

Dated 11/24/1997 by Bruce C. Travers, R.G., for EMCON

No.	Comment	Response
2.1	Comment re: Page 1-32 of the RI. What evidence is there that significant amounts of contamination is moving to the MAU through wells with cascading water? Have these conduits been identified and if so have they been sealed to prevent further cross-contamination?	Testing and visual observation of one well indicated the potential for contamination to cascade down to the MAU via this route. EPA's selected remedy includes sealing or abandonment of that well.
2.2	Comment re: Page 1-33 of the RI. Why are the soil and soil gas data from comprehensive investigations being conducted by PRPs not reflected in the RI or the Preliminary Property Investigations in Appendix S?	Evaluation and incorporation of all PRP data was not part of the original scope of the RI, the primary focus of which is the groundwater contamination. These data have been compiled by EPA and will be provided in the PPI update, a forthcoming document and in Focused RIs. Much of the data, earlier PPIs, and Focused RI work concerning soils is included in the Administrative Record for this ROD.
2.3	Comment re: Page 2-3 and page 5-31 of the RI. The RI states that SRP well 23-2.9 is screened throughout the UAU, MAU and LAU. Is this well a cause of cross-contamination from the UAU to the MAU and LAU? If so, what has been done to prevent further cross-contamination?	See response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comment No. 2.1.
2.4	Comment re: Page 2-8 of the RI. A narrative description is given for the extent of contamination on the UAU and MAU/LAU, but the RI lacks in presenting a temporal display of quarterly water quality results. Water quality contour maps are necessary to illustrate the change in water quality concentrations over time. Water quality hydrographs are also necessary to show how the various chemicals of concern have behaved over time. The lack of adequate presentation and discussion of the water quality and the associated trends is the most serious deficiency of the RI report. A review of the water quality data indicates that there are 3 separate and distinct plumes within the UAU. These plumes are separate in location and distinct by compounds of concern. This fact should be more apparent in the RI report and should lend an analysis of implementation of Operable Units (OUs) in the Feasibility Study.	The contours in Figures 6-39 and 6-40 of the RI depict the estimated extent of TCE and PCE contamination in the UAU and MAU aquifers, respectively. Appendix I of the RI presents time series plots of groundwater elevations and contaminant concentrations for the wells in the IBW-South study area. Figures 6-20 through 6-27 of the RI, which do not have contour lines, plot either maximum contaminant concentrations, or contaminant concentrations for a specific sampling event. Data are in the Administrative Record. The other recommendations in the comment are not necessary to the RI. See also response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comment No. 1.0 concerning the presentation of groundwater data. EPA has not determined that the areas of contamination are separate and distinct; further data analysis is warranted. EPA believes it appropriate to proceed with remediation of groundwater sitewide and does not believe that division of the site into separate groundwater OUs would expedite those efforts.

Comments from Prestige Cleaners, Inc., & Arizona Jacobson Co.

Dated 11/24/1997 by Bruce C. Travers, R.G., for EMCON

No.	Comment	Response
3.0	Comment re: Page 2-9 of the RI. The RI presents discussions on significant "uncertainties" in the understanding of the site conditions present in the SIBW area. What is lacking is a discussion of how these "uncertainties" will be addressed in the future. It is curious that the "downgradient extent" of the western and eastern "plumes" may not yet have been defined but the feasibility study is able to determine, through modeling, plume capture. It is evident that the modeling assumption are faulty, resulting in inappropriate and inaccurate model results. These faulty results are then used in the feasibility study, resulting in inappropriate analysis of the various remedial actions. How can you determine an appropriate Remedial Action when the extent of contamination is still unknown?	The exact extent of the contamination does not have to be defined to prepare a technically sound feasibility study. The comparison of alternatives incorporates these uncertainties. The optimum locations for extraction wells do not need to be defined in the FS, but will be defined during the remedial design process. EPA disagrees that the EPA modeling assumptions are "faulty," and appropriate analysis of the various remedial action alternatives has been performed. If, during remedial design, it is determined that the extent of contamination is farther downgradient, then there would be some change in cost. However, it could be an increase or a decrease, depending on location of existing canals and/or storm drains, existing open areas for treatment plant locations, etc. The change in the cost would not significantly affect how one alternative compares to other alternatives.
3.1	Comment re: Page 2-12 of the RI. The RI states that the Risk Assessment information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action. The baseline risk assessment was to be based upon a reasonable maximum exposure. The risk assessment did not take into account the degradation rates that have been detected since monitoring began. Reviewing the water quality trends indicate future potential threats to human health and the environment may be non-existent due to natural attenuation. Why wasn't this addressed in the Risk Assessment?	The data used to estimate the potential for risk from groundwater exposure represent a snapshot of concentration trends taken over time. Information regarding the trends was incorporated by presenting the time series plots showing the ILCR versus sample date. This information shows that the risks trend both up and down over time, and no steady decline in risk is evident. Further, there are no definitive methods available that allow quantification of degradation rates for mixtures of chemicals. At best, degradation rates for individual chemicals could be considered, but degradation rates for chemical mixtures have not been quantified. The uncertainty associated with quantifying the potential for contaminant degradation would preclude useful interpretation of the results.
3.2	Comment re: Page 4-3 of the RI. Why aren't data collected by the PRPs included in Section 4-Vadose Zone? Without a full assessment of all data, this section is deficient.	Evaluation and incorporation of all PRP data was not part of the original scope of the RI, the primary focus of which is the groundwater contamination. PRP data have been reviewed by EPA and will be provided in the PPI update, a forthcoming document, and/or in Focused RI reports. Generally, available PRP data were considered for this remedy selection document, and EPA does not consider the RI's vadose zone discussion deficient for not summarizing all PRP data in the RI.
3.3	Comment re: Page 6-1 of the RI. The section entitled, Section 6- Evaluation of Groundwater Data, is deficient in presenting maps depicting quarterly water quality data or individual water quality hydrographs. Only maps depicting VOC concentrations in July, 1994 and maximum concentrations are projected. No discussion is presented with regards to the trending of the water quality data. A review of the data presented in Appendix K of the RI and Appendix F of the FS indicate that for most monitor wells, VOC concentrations are on a decreasing trend, and in many cases, are at or below Maximum Contaminant Levels (MCLs). A section needs to be added which adequately addresses the water quality trending.	The chemical concentration trends, and some factors, such as the change in water levels, which may influence them, are discussed in Section 6 of the RI. The number and variability of these possibly controlling factors that may occur at any particular well is discussed. The influences they may have on groundwater quality at a particular well are difficult to quantify. In addition to the information presented in the RI, time series concentration plots were presented using data through October 1997, in an August 1998 Technical Memorandum and a groundwater data memorandum. These memoranda were distributed to the commentor and entered into the Administrative Record in August 1998. See also response to Prestige Cleaners & Arizona Jacobson Co.'s Comment No. 2.4.

No.	Comment	Response
3.4	Comment re: Page 6-7 of the RI. The July 1994 data does not present the most recent data. What was the reason(s) in selecting July, 1994 versus the most recent data?	It was administratively necessary to have a cutoff date in order to complete the data review, analysis, and preparation of the FS. EPA considered data through 1996 in determining partial target volumes. Updated data and modeling based on those data have been distributed to the commentor and entered into the Administrative Record. That review of more recent data and modeling did not alter conclusions reached in the RI/FS, but did add support for the adoption of MNA as an expanded part of the remedy for the central and eastern UAU contaminant areas.
3.5	Comment re: Page 6-9 of the RI. Nine wells are presented to define the extent of contamination of PCE in the eastern portion of the SIBW area. A review of the most recent data (1995 or 1996) indicates that in 7 of the 9 wells, the PCE concentrations have declined. 5 of the 7 are at 5 micrograms per liter (ug/l) or below, with a maximum PCE detected concentration of 19 ug/l. The 1997 data indicate the maximum PCE has declined to 15 ug/l.	This comment refers to recent water quality data that were evaluated and considered in selecting the groundwater remedy, and which support the adoption of MNA for part of the site's remedy.
4.0	Comment re: Page 6-10 of the RI. Nothing is mentioned in the summary regarding the trending of the water quality data, nor the marked reduction in VOC concentrations over time.	Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 3.1 and 3.3.
4.1	Comment re: Page 6-15 of the RI. A discussion is needed addressing the natural attenuation which is being achieved at the site. A narrative is needed which addresses the dilution and dispersion of contaminations due to the high horizontal conductivities and high recharge rates during flow events in the Salt River.	Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comment No. 1.0. The RI presented calculations in Section 6 which estimated the potential impact of the flow events on groundwater movement. The FS also incorporated these high recharge rates during flow events by evaluating this extreme groundwater flow condition.
4.2	Comment re: Page 6-23 of the RI. Thorough more discussion of the water quality trends and current (1996) water quality data is needed. The discussion of historical maximum VOC concentrations is irrelevant. Discuss what is there currently and what is the potential for further reductions in VOC concentrations.	Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 2.4 and 3.3. The discussion of maximum concentrations is significant for characterization and understanding of the site, particularly given fluctuations of concentrations of contaminants at IBW-South over time.
4.3	The Feasibility Study (FS) has failed, as did the Remedial Investigation report, to adequately present, discuss, and integrate into the FS, the discussions of the degradation and natural attenuation of VOC's that has occurred and continues to occur. Without including the effects of natural attenuation, the development and analysis of remedial alternatives have been fatally flawed and do not represent the true site conditions.	Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 1.0 and 4.1. Natural attenuation processes and site conditions were adequately considered throughout the RI/FS and remedy selection process. MNA was considered in Alternative 2 and was proposed as a portion of Alternative 4 in EPA's Proposed Plan, and upon further review of more recent data, has been selected as a component of the final remedy. This process was not fatally flawed.

Comments from Prestige Cleaners, Inc., & Arizona Jacobson Co.

Dated 11/24/1997 by Bruce C. Travers, R.G., for EMCON

No.	Comment	Response
4.4	The data indicates the plumes are separate. The option of addressing each plume as operable units (OUs) is not discussed. It appears from review of the data, that an OU approach is appropriate for SIBW and should be revisited by EPA. If EPA had analyzed the trends of the water quality data, it would have been apparent that natural attenuation is actively occurring. If EPA had reviewed the current analytical data with respect to the distinct nature of each plume and the rapid reduction in VOC concentration within each plume, it would have been obvious for the central and eastern plumes that natural attenuation is the most appropriate remedial action.	Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 1.0 and 2.4. EPA has selected MNA as a component of its remedy for the central and eastern contaminant areas. A contingency remedy of extraction and treatment is included if it becomes apparent during Remedial Action that MNA is not meeting the remedial action objectives of the ROD.
4.5	The target volumes used for the FS are not realistic. The FS should use the most recent data set to determine the target volumes. It appears that 'worst case' data were used. The fact that degradation and natural attenuation has occurred and continues to occur was left out of any FS analysis.	As EPA explained in the Proposed Plan, EPA always conceived that target volumes of groundwater to be extracted would be determined during remedial design based on the most current data and analysis of groundwater contaminant distribution at IBW-South. Natural attenuation has been fully considered. Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 1.0 and 4.1.
5.1	Comment re: Page 3-9 of the FS. As were presented in the RI comments, the extent of contamination needs to present the most recent data set, a discussion of the water quality trends and a discussion of the observed degradation and natural attenuation, which has and continues to occur at the site. July 1994 data should not have been used to present the nature and extent of contamination. The 1996 data are obviously more representative of the current site conditions. The estimated target volumes are greatly reduced using the more current data set. Why ignore the current data? The water quality trends and the current data set support natural attenuation as the most appropriate remedial action in SIBW.	Please see responses to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 1.0, 3.1, 3.3, 3.4, and 4.5. EPA agrees that MNA is appropriate for the central and eastern contaminant areas, but not the western, and has adopted a contingency remedy to be employed if MNA is insufficiently effective.
5.2	Comment re: Page 5-2 of the FS. The target volumes should be estimated using the most current data set. The target volumes greatly exaggerate the volume of impacted water and lead to inappropriate remedial actions being moved forward through the FS process. This has fatally flawed the FS process.	As EPA explained in the Proposed Plan, EPA always conceived that the target volumes of groundwater to be extracted would be determined during the remedial design based on current data. The exact volume of groundwater to be extracted need not be quantified to analyze a set of appropriate remedial actions throughout the FS process, as EPA has done here. This process has been successful as the adjustment of target volumes to be extracted discussed in Section 10 of this ROD for IBW-South. It was necessary for the FS to analyze alternatives that could, under EPA's remedial action objectives, address the ever-fluctuating contaminant levels at IBW-South. Thus, the FS process was not flawed.
5.3	Comment re: Page 8-2, Alternative 2 - Natural attenuation/ groundwater monitoring/ well permits/ groundwater use restrictions of the FS. The FS detailed evaluation of alternatives states that the time until preliminary cleanup goals would be achieved through the natural attenuation process would be less than 30 to 50 years for the central and eastern plumes. This seems like the best alternative for these plumes given the fact that the evaluated plume target volume and concentrations used in the analysis are high and not representative of the most current plume conditions. If the most recent data set were used, it is highly probable that the preliminary clean-up goals will be achieved in much less time than 30 years.	As stated in the Proposed Plan, Alternative No. 2 is not protective because natural attenuation alone will not meet MCL cleanup levels within a reasonable timeframe, particularly in the western area. Furthermore, the plume would migrate a significant distance, estimated to exceed one mile in the case of the western plume, further contaminating clean aquifer areas. EPA has adopted MNA as the appropriate remedy for the central and eastern contaminant areas, and EPA expects that it will restore those areas within a reasonable time frame of approximately 30 years.

No.	Comment	Response
5.4	Comment re: Page 9-10 of the FS. Which remedial alternative is the suggested alternative, and where is the state acceptance analysis for each alternative?	As stated in the opening paragraph of Section 9.0 of the FS, the comparative analysis "identifies the advantages and disadvantages of each alternative...so that key tradeoffs can be assessed during the decision-making process of the Proposed Plan." In other words, the FS only presents and compares each alternative; the Proposed Plan analyzes that information and presents which alternative is preferred. Alternative 4 is the preferred alternative in the Proposed Plan. The last sentence of Section 8.0 of the FS states "the final two criteria, State Acceptance and Community Acceptance, are the modifying criteria and are not evaluated until after the public comment phase on the FS and Proposed Plan." The state concurs with the selected remedy, and its acceptance of the selected remedy is addressed in Sections 9 and 13 of this ROD. Further documentation of State acceptance is in the Administrative Record.
5.5	Comment re: Appendix A of the FS. The results of the groundwater Risk Assessments do not seem to play much of a role in the alternatives analysis. How were the results of the groundwater Risk Assessment used in the alternatives analysis?	The risk assessment is one of the factors EPA uses to determine if an action is warranted. The FS evaluated remedies that might reduce the baseline risks posed by potential exposure to contaminated groundwater if groundwater were not remediated. The nine criteria of the NCP are considered in the evaluation of alternatives. The decision selected by EPA considered the results of the risk assessment in evaluating the protectiveness of the remedy. Please see response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-5.2.
6.0	Comment re: Appendix E of the FS. The Groundwater Flow and Solute Transport Analysis section is poorly presented and does not allow a rigorous analysis of the work conducted. Requests were made to CH2M Hill for further model documentation, but we were told that no additional documentation existed. This document, as it stands, can not be critically reviewed.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration and follows the ASTM guidance for groundwater model documentation. The necessary information is presented to allow for a critical review of the FS.
6.1	Comment re: Section E.6.1.4 of the FS. A major deficiency in the model is evident in this section. This section states, "The effects of degradation were not incorporated in this evaluation. These mechanisms are not likely significant at IBW-South." Again, the review of the time series data strongly indicates a "degradation mechanism". The results of the model do not adequately simulate the observed reduction in VOC concentrations over time.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides documentation of the evaluations performed using more recent data. The text was referring to biological degradation. Other natural attenuation processes such as dispersion and dilution were incorporated. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 07.0, IMC Magnetics Corp.-Mr. Jenkins' Comment No. 3-1.0, and Prestige Cleaners & Arizona Jacobson Co.'s Comment No. 1.0.

No.	Comment	Response
6.2	It is obvious that the selective use of the data have predisposed EPA in selecting an exorbitantly expensive pump and treat system as the selected remedial action. The RI and resulting FS are fatally flawed due to the selective use of data and are therefore inconsistent with the National Contingency Plan (NCP). Our review has shown that the selected pump and treat remedial action selected based upon the RI results could not be deemed to be reasonable, necessary, or appropriate.	EPA rejects the commentor's claims that EPA has engaged in the "selective use of data" and that the data EPA relied on during the FS process have biased the remedy selection process. EPA's use of data and its analysis of those data are scientifically appropriate and not inconsistent with the NCP. Please refer to response to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 3.3 and 3.4 concerning data used in the FS. The remedy preferred in the Proposed Plan is reasonable, necessary, and appropriate based on the data in the RI and the more recent data included in the Administrative Record. EPA has, in response to more recent data, modeling based on those data, and comments, selected MNA as the remedy for parts of the site. The selected remedy is cost-effective, reasonable, necessary, appropriate, and supported by site data.

Comments from Salt River Project

Dated 9/8/1998 by Kevin G. Wanttaja, Manager, Environmental Compliance

No.	Comment	Response
3.0	On September 8, 1998, SRP submitted comments on EPA's groundwater flow and solute transport model documented in the August 12, 1998, memorandum. In general, the comment stated that (1) the water budget output of 500 acre-feet per year of cascading flow at the SRP Well #23E-2.9N is substantially overestimated, and (2) a transient groundwater flow model should have been used in addition to the steady-state flow model.	Although these comments were submitted well after the close of the comment period, EPA reviewed and considered this submittal from SRP in selecting the final groundwater remedy for IBW-South. The comment contains no substantial support for any significant alteration of the remedial action. These comments were also discussed at the August 31, 1998, stakeholders' meeting in Phoenix, Arizona. SRP's comments are included in the Administrative Record. EPA concluded that these comments would not alter the remedy selection. Regarding Item 1, the Groundwater Feasibility Study report stated that based on spinner-logging of the SRP Well 23E,2.9N, an estimate of 500 acre-feet per year could be flowing downward from the UAU to the MAU. The uncertainties in the stratigraphy of the MAU near this well are also discussed in the Remedial Investigation report. Downward flow was measured during the spinner log test. The exact volume is not known, but the estimate of 500 acre-feet is based on actual field measurements. Other comments were received regarding Item 2, and responses have been provided. See responses to Arizona Public Service Comments FS5.3 and FS5.4, and IMC Magnetics Corporation Comments 1-05, 4-1.0, 4-1.2, and 4-2.4. EPA believes the approach that was used, which evaluated a range of steady-state groundwter flow conditions, is justified.

Comments from Salt River Project

Dated 11/25/1997 by Richard M. Hayslip for Environmental, Land & Risk Management

No.	Comment	Response
1.0	SRP appreciates the opportunity to comment on the Proposed Plan for cleanup of VOC contaminated groundwater in the South Indian Bend Wash (SIBW) Superfund site. The SRP has one well in the site, 23E-2.9N, that has been contaminated by VOCs. Several other downgradient wells are at risk if the plume is not contained and remediated. These wells are an important component of SRP's water supply, particularly during drought conditions.	Consideration of this potential future exposure is consistent with the NCP, under which groundwater is viewed as an inherently valuable natural resource to be protected and restored. This factor supports the selected remedy, which will allow some limited migration of VOC contaminants in groundwater, but all VOC contamination is expected to be at health-based levels within approximately 30 years. EPA's selected remedy calls for the sealing or abandonment of Well 23E-2.9N in order to eliminate it as a potential path of VOC contaminant migration from the UAU to the MAU.
1.2	SRP generally supports EPA's proposed plan because it will result in the restoration of existing impacted wellsites and protect downgradient wells from further spread of contamination. SRP would like to have further discussions with EPA on the nature and extent of the proposed groundwater use restriction. SRP is concerned that this restriction not impair SRP's rights to pump groundwater on behalf of its shareholders. We support controlling the amount of pumping so as not to exasperate [exacerbate] plume migration. However, SRP should not be restricted from using its wells to meet shareholder water demands during drought conditions.	Both before and after the comment period, EPA has conducted a number of discussions with SRP staff about these concerns; well siting, permitting, and construction restrictions, along with notices distributed, will be used to protect the public from exposure to contaminated groundwater. EPA looks forward to continued work with SRP on these and related issues.
1.3	EPA's proposed plan also states that SRP well 23E-2.9N would be sealed to eliminate VOC contaminant migration from the UAU to the MAU. SRP has cooperated with EPA in conducting hydrogeologic tests of this well and we would support EPA efforts to prevent downward migration of VOC contamination. Additional studies should be conducted before making a final determination on the most effective way to modify this well. SRP suggests that EPA consider incorporating well 23E-2.9 into the partial plume containment plan. Under this scenario, the MAU would be temporarily sealed off and the well would extract water only from the upper unit.	EPA will coordinate with SRP to determine the specifics of modifying this well, which will be sealed or abandoned. The selected remedy does not include pumping from the UAU at this location, so the option of using the upper screen interval and sealing the screen interval in the MAU is not desired.
2.0	SRP appreciates EPA's giving consideration to discharging the treated groundwater to the Tempe Canal for use as a municipal and irrigation water supply. Should EPA decide that the Tempe Canal is the preferred beneficial use of the treated groundwater, SRP will work with all involved parties to ensure that appropriate safeguards are incorporated in the system operation to ensure water quality standards are always maintained in the canal. However in this situation, SRP believes preference should be given to using the remediated water in the City of Tempe's Rio Salado Project. The water would be used in maintaining water levels and water quality in the Tempe Town Lake which is being developed to promote recreational uses and commercial development along the dry Salt River. The Tempe Town Lake project compliments EPA's efforts to promote sustainable development in urban areas because it will encourage development near the center of the urban area, and will provide residents with nearby recreational opportunities.	As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA looks forward to working with SRP and the community during this process.

Comments from Salt River Project

Dated 11/25/1997 by Richard M. Hayslip for Environmental, Land & Risk Management

No.	Comment	Response
2.1	The Tempe Town Lake will be located on non-member lands within the Salt River bed. Although these lands are not entitled to water pumped from SRP member lands, Tempe and SRP have been meeting to work out this issue under the provisions of prior agreements. SRP and Tempe fully expect to work out an acceptable arrangement which allows for the SIBW water from member land sites to be used in the Town Lake. One option being considered is to build a connection from the Tempe Town Lake to the SRP Grand Canal. This connection could provide several water quality and operational benefits to the lake and SRP. Other options are also available to address the groundwater rights issue.	As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA looks forward to working with SRP, the City of Tempe, and the community during this process.
2.2	SRP would like to meet with EPA and City of Tempe to discuss treatment of SRP well 23E-2.9N and use of remediated water in Tempe Town Lake.	EPA will meet with SRP again during the remedial design phase.
2.3	EPA is to be commended for the work it has done in finalizing the proposed plan. We encourage EPA to continue its efforts toward implementing the plan and restoring the area's groundwater resources.	EPA is continuing its efforts to bring about the remedial action.

Comments from Unitog Rental Services, Inc.

Dated 5/18/1998 by Houmao Liu, Ph.D., and Robert J. Sterrett, Ph.D., for Hydrologic Consultants, Inc.

No.	Comment	Response
1	Unitog Rental Services presented results of groundwater modeling at the May 27, 1998, stakeholders meeting. The groundwater modeling was documented in a May 18, 1998, letter report to Mr. John Chen (Unitog Rental Services) by HCI Consultants, titled "Ground-Water Flow and Solute Transport Modeling, South Operable Unit East Plume, Indian Bend Wash Superfund Site." The main focus of the groundwater flow and solute transport modeling was to evaluate whether the current concentrations of tetrachloroethene (PCE) in the eastern contaminant area at the SIBW site will naturally attenuate to below 5 micrograms per liter in an acceptable time frame. The letter concludes that the solute transport modeling effort demonstrates that concentrations of PCE will decrease below 5 micrograms per liter by the year 2020, and that although the 5 microgram per liter contour will move downgradient, the area with concentrations above 5 micrograms per liter shrinks over time. Lastly, active remediation of groundwater is not required as the plume will naturally attenuate in an acceptable time period.	Although this comment was submitted well after the close of the public comment period, EPA reviewed and considered this submittal from Unitog in selecting the final groundwater remedy for IBW-South. The comment contains no substantial support for any significant alteration of the remedial action. The HCI letter report is included in the Administrative Record. EPA concluded that the comment would not alter the remedy selection. The groundwater concentration distributions predicted by HCI for the eastern contaminant area are similar to the predicted groundwater concentrations presented in the Groundwater Feasibility Study. HCI predicted the eastern contaminant area would migrate about 3,500 feet downgradient of its position in 1997 within 22 years, but that the area contaminated above the MCL of 5 micrograms per liter shrinks over time. The Groundwater FS predicted that the eastern MCL plume would migrate about 2,000 feet. Both predictions pertain to contaminated groundwater in the UAU. The revised groundwater modeling presented in EPA's August 12, 1998, memorandum titled "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models Technical Memorandum" also predicts that the MCL plume would migrate about 2,000 feet, and that MCLs will be met within about 16 years.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
02-0	Water Quality Trends do not support the use of active remediation. EPA, its contractors, and Potentially Responsible Parties (PRPs) have been collecting ground water quality data since 1983. Over 60 wells are routinely monitored throughout the three plumes. In all plumes both PCE and TCE concentrations have shown a steady decline since at least 1991. Across all three plumes, the average concentration of TCE has not exceeded the MCL since 1995. TCE in the Eastern plume has averaged less than the detection limit since 1991. The highest concentration of TCE detected anywhere in 1997 is 27 µg/l within the Western plume. PCE is found at an average concentration of less than one half of the MCL in the set of all shallow plumes wells (2.34 µg/l, 1996). The average concentration of PCE in the Eastern plume, where PCE is the signature compound, was 4.57 µg/l in the second quarter of 1996, and has remained below the MCL since that time. It is common knowledge that pump-and-treat systems are ineffective in removing any significant amount of mass where only trace amounts are found. Further, the system if constructed, would not "but for" natural attenuation, result in any marginal risk reduction from the status quo.	Groundwater contaminant concentrations at significant areas of IBW-South exceed MCLs or other aquifer cleanup ARARs, necessitating remedial action. Active remedial action is warranted at the western area because EPA modeling has shown that, without active measures, contaminant levels will not be restored to MCLs within a reasonable time frame, and contaminants above MCLs will migrate an unacceptable distance. EPA's preference for permanent reductions in contaminant toxicity, mobility, or volume by treatment, and the other nine NCP criteria also support this active remediation. EPA has selected MNA as the remedial action necessary to restore and maintain restoration of the central and eastern areas. Please see responses to Prestige Cleaners & Arizona Jacobson Co.-Mr. Travers' Comments No. 3.1 and 5.3. Regarding the last paragraph in the comment, the objective of the remedial action is not to maximize mass removal. Pump and treat systems are effective at hydraulically capturing groundwater to prevent contaminant migration. Risk reduction will occur as areas currently above MCLs will be restored.
02-1	Current and future risks associated with contaminants of concern (COCs) do not support the application of active remediation of ground water. Applying the overly conservative risk assessment of CH2MHill, which used historical data to predict a theoretical future exposure, there are no individual wells in the Eastern plume that exhibit an ILCR greater than 1x10-5. CH2MHill uses 1x10-5 as their point of departure for spatially identifying the zone warranting a remedial measure. In fact, none of the 63 wells sampled throughout all of the plumes exhibited an ILCR greater than 2x10-5. Separate and apart from this observation it is evident that an accurate risk assessment was not performed. Accounting for several technical inaccuracies and applying forward water quality trends, both current and future risks of ground water as a public drinking supply are substantially lower than published by CH2MHill.	See the response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-3.2. The commentor provides no quantitative analysis to support the contention that the current and future risks are lower than estimated in the baseline risk assessment. EPA disputes that its risk assessment was inaccurate, but recognizes that such efforts involve uncertainties.
02-2	Flawed numerical ground water flow and chemical transport modeling resulted in erroneous predictions of long term plume migration. Gross over-simplifications of aquifer dynamics coupled with inaccurate particle tracking techniques have led CH2MHill to suggest the plumes will migrate several thousand feet in the coming years. This will not happen. A simple review of down gradient water quality demonstrates this contaminant slug does not exist. These plumes will continue to decrease in concentration naturally as they have been for many years. We have validated these field observations with analytical dispersion modeling that indicates CH2MHill's model cannot be accurate if any dilution or mechanical dispersion exists. Mechanical dispersion in three dimensions is actively diffusing each plume.	Unitog has submitted results from groundwater modeling performed subsequent to when this comment was submitted that also predict that the plumes will migrate more than 2,000 feet. These results are similar to those presented by EPA. This reviewer did not perform a quantitative evaluation and is using water quality data at select wells to make generalized predictions about future plume movement.

No.	Comment	Response
03-0	The preferred remedy is inconsistent with the NCP. EPA has clearly ignored compelling water quality trends in its rejection of natural attenuation. EPA, through its contractor CH2MHill, has published a scientifically indefensible series of engineering calculations that resulted in misleading analysis of the nine NCP criteria. The baseline Risk Assessment that was conducted fails to meet the minimum standards derived from the NCP and related EPA guidance. The marginal risk reduction achieved by active remediation does not support its implementation. In the event active remediation is carried out, it is unlikely that 25 percent of the resident mass can be removed from this diffusion limited aquifer in the first 5-10 years of pumping. Thus, absent naturally occurring forces that influence water quality, the incremental reduction in mass due to the pumping system is negligible. Any measurable mass of COCs amenable to ground water extraction will be swept from the aquifer skeleton in the first two bulk water exchanges. The system design for Alternative No. 4 calls for 4 to 5 bulk aquifer exchanges every year. As a consequence it is unlikely that diffusion forces will be allowed to introduce measurable mass over time.	Neither the preferred remedy in the proposed plan nor the selected remedy is inconsistent with the NCP. EPA has evaluated site data and other information and appropriately determined that it forms the basis for the selected remedy, which employs MNA at significant portions of the site. Although data used in the FS and Proposed Plan indicated that MNA alone would not remediate all of the contaminated area, more recent data and modeling have shown that it can be employed without extraction and treatment in the central and eastern areas. The risk assessment and engineering calculations are scientifically valid and defensible because the available data were evaluated properly and considered in the selected remedy. See response to Unitog Rental Services Corporation's Comment No. 02-0. EPA's risk assessment complies with the NCP and EPA guidance. See response to IMC Magnetics Corp.-Mr. Hudson's Comments No. 6-1.0 and 6-5.2. Active remediation is necessary, as set forth in that comment. The progress toward the remedial action objectives is evaluated during each 5-year review period. Moreover, quarterly monitoring will enable EPA to evaluate remedial progress as needed. If concentrations are not declining and the aquifer restoration is not progressing, then appropriate changes in the remedial action can be made.
04-0	CH2MHill mischaracterizes the aquifer tests. The RI and FS claim to have adequately characterized the aquifer by conducting 36 aquifer tests yielding transmissivity values of between 1,900 and 73,000 ft2/day. They go on to state that these values appear to be log-normally distributed with a geometric mean of 17,000 ft2/day. However, only two of these tests are "pumping" tests with the rest being "slug tests". Moreover, no breakdown is given as to which aquifer was being evaluated. The results of the two "pumping tests' range from 500 to 51,000 ft2/day for the LAU and UAU, respectively. Neither of these two aquifer tests conform to minimum standards developed by the U.S. Geological Survey. These results are qualified with the statement, Due to the small magnitude of the drawdown observed in the UAU in response to the MAU pumping, this estimate has a large degree of uncertainty and probably overestimates the true UAU transmissivity at this location.	Short-term constant-rate pumping tests were performed at each of the monitoring wells, not slug tests. Slug tests involve the instantaneous injection or removal of a small volume of water. Short-term pump tests are commonly and appropriately used to estimate aquifer transmissivity. All of the aquifer tests were performed according to standard protocol developed by the USGS. Drawdown and flow rate from the pumping well was carefully measured throughout the tests, and recovery was monitored following cessation of pumping. The test data from the pumping phase of the tests were interpreted using the Cooper and Jacob method while the data from the recovery phase of the test was interpreted using the Theis recovery method. Both of these analysis methods are fully discussed in "Analysis and Evaluation of Pumping Test Data" by Kruseman and deRidder, 1991.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
04-1	As noted above, transmissivity is reported to range over 2.5 orders of magnitude and is not spatially co-dependent (see p 3-1). Nevertheless CH2MHill applies a single average transmissivity value for the entire 15mi2 aquifer in its numerical model. There is no statistical strength to the assertion (p.3-1) that transmissivity is log-normally distributed and that a geometric mean is valid for use nor is there any basis to apply a transmissivity value of 17,000 ft2/day in the UAU. CH2MHill failed to collect requisite data from core holes that would have allowed a more accurate assessment of chemical transport through ground water. As examples, data for the following are not provided but are critical for use in chemical transport modeling; grain size distribution, bulk density, total organic carbon, dissolved oxygen, drainable porosity, and soil mineralogy.	The transmissivity distribution was revised in the recent groundwater model evaluation documented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. This technical memorandum provides additional information regarding model calibration. The bulk density and total organic carbon values used in the contaminant transport modeling are based on field measurements conducted at the site, and agree with typical values observed for the types of sediments present at IBW-South. The dissolved oxygen concentration assumed for the groundwater is reflective of the aerobic conditions that exist in the aquifer at IBW-South. Measurements of grain size distribution, drainable porosity, and soil mineralogy are not required input for the contaminant transport analysis performed by EPA.
04-2	A significant failure of the RI was the decision not to conduct tracer tests. The dominant factor influencing chemical concentrations in each of the plumes is mechanical dispersion. During periods of recharge, dilution becomes the overwhelming factor as evidenced by the capacity of recharge to significantly alter flow directions and velocities. As a consequence of not measuring dispersion coefficients in three dimensions, the ground water model underestimated the magnitude of longitudinal dispersion and omitted a large transverse dispersion vector. Looking to measurements of dispersion coefficients under similar hydrogeologic conditions, an appropriate longitudinal dispersion coefficient is approximately 320 ft, 3.2 times greater than the value used by CH2MHill. CH2MHill completely ignored transverse dispersion which is on the order of 33 feet and 3 feet vertically. In fact the vertical component is most likely even greater, as CH2MHill notes when they characterize the large vertical gradients between the upper and middle aquifers.	The scale of the site and the excessive volumes of tracer that would have to be injected to the aquifer make this a very inappropriate method for estimating dispersion. See also response to the previous comment. The groundwater flow and transport modeling performed by Unitog subsequent to this comment did incorporate transverse and vertical dispersion, and the results were very similar to the updated modeling effort performed by EPA.
05-0	Although CH2MHill, or others on behalf of the EPA, have drilled no less than 63 boreholes in the aquifer and well logs for many other wells exist, CH2MHill does not attempt to produce a usable graphical interpretation of the subsurface. Rather, they rely on simplistic cartoons to represent a highly generalized depiction of a 15mi2 aquifer.	The RI contains the detailed graphical interpretations of the subsurface. There are six detailed cross-sections in Section 5.0 of the RI.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
05-1	Comment re: Page 3-4 of the FS and Appendix E of the RI. CH2MHill asserts ground water flow in the UAU originates mainly from Salt River recharge, but fails to quantify or even qualify the Salt River recharge influence on contaminant dilution and dispersion. Duration of recharge events can exceed two months, a sufficient amount of time to completely turn over an aquifer volume. The RI suggests that changes in the water level may be influencing the concentration of the chemicals in the wells, but this concept is lost in the FS from engineering and numerical modeling perspectives. CH2MHill goes on to note that pulse recharge events dramatically affect the hydraulic gradient (actually tripling it), and the ground water flow direction is altered by nearly 90 degrees. A net rise of 30 to 70 feet in ground water elevation is attributed to river flow conditions. Nevertheless, the numerical model offered by CH2MHill in Appendix E does not appear to take either of these dramatic deviations into account. Our analytical prediction of this spreading effect indicates that transverse dispersion is effectively increased by a factor of 4 (approx. 125 ft.) and longitudinal dispersion effectively increased by up to 50 percent (approx. 450 ft.). By comparison, CH2MHill uses a longitudinal dispersion coefficient of 100 ft and 0 ft in the transverse direction. A simple complete mix model that incorporates a three fold increase in volumetric flux during recharge events results in a 24 percent decline in COC concentration for each recharge event lasting more than 4 weeks. In our view, CH2MHill has not considered the influence of recharge events that, in and of themselves, do more to reduce COC concentrations than 5 to 10 years of pumping under Alternative No. 4. CH2MHill did not publish any modeling scenarios which reflect the influence of recharge events so we assume recharge was neglected.	Groundwater modeling did evaluate a range of groundwater flow conditions, including river flow events and Town Lake recharge. These calculations were presented in the water budget evaluation in the RI and are described in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. Sensitivity analyses were also performed on the longitudinal dispersivity. The well locations and required extraction rates were estimated for a range of groundwater flow conditions and were documented in Appendix D of the FS. It is agreed that the recharge events have significant effects on reducing contaminant concentrations. These same recharge events also cause significant plume migration. The remedial action objectives include seeking to limit migration of the groundwater contaminated above MCLs and meet cleanup levels within a reasonable time frame.
05-2	Comment re: Page 3-4 of the FS and Appendix E of the RI. CH2MHill contends there is a large vertical gradient into the MAU (0.15-0.2). While we do not question the measurement, dispersion in the vertical direction further diffuses COC concentrations. CH2MHill notes that the vertical gradient increases by up to 33 percent during recharge events. Numerical modeling by CH2MHill does not appear to take these observations into account when determining the transport of trace COCs spatially or temporally. CH2MHill fails to provide ground water equipotential graphs which could be used in determining the hydraulic gradient. Inclusion of these common graphs would allow a scientist to determine whether gradients are variable within the aquifer and if so, where. The reader is left to assume CH2MHill accurately represents the hydraulic gradients in the aquifer with and without recharge events. It is unlikely the single numerical values applied by CH2MHill exist. In fact, a random check of well pairs in each plume using data provided in Appendix H indicates gradients deviate from one pair to another by over 30 percent between plumes, and by over 20 percent within a given plume.	Water level hydrographs are provided in the RI which can be used to calculate the vertical gradient. The RI discusses the range of both horizontal and vertical gradients. See response to Unitog Rental Services Corporation Comments No. 02-2, 04-2, and 05-1.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
06.0	For nearly all wells, levels of PCE and TCE have been decreasing steadily, and have already reached, or will soon reach, MCLs.	This statistical analysis presented with this comment, which is part of the Administrative Record, does not incorporate the rate of groundwater movement, and the fact that the downgradient edge of the contaminant area is not defined for the eastern and western areas. The analysis ignores that there are several wells in which contaminant concentrations are clearly increasing. This evaluation was presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. EPA evaluated these contaminant concentration trends in selecting the remedy set forth in this ROD.
09-0	Comment re: Page 2-5 of the FS. CH2MHill states that the Superfund site has had "many sources" but never mentions any of them other than one well in each plume. To properly understand the contaminant transport dynamics in the subsurface a clear understanding of the source terms is required. CH2MHill should identify to the extent possible the sources, the magnitude of each source and its remediation, if any. In turn this information should be applied to contaminant fate and transport modeling.	EPA has identified 72 facilities within Indian Bend Wash-South which may be potential sources of contamination. To date, the EPA has conducted 55 Preliminary Property Investigations to further evaluate some of these facilities. These investigations have thus far resulted in the identification of eight "subsites" where elevated levels of VOCs have been detected. These facilities and subsites are identified in the RI and the FS, the primary focus of which is the groundwater at IBW-South, as well as in existing PPIs and Focused RIs that are a part of the Administrative Record. The RI and FS adequately summarize the known sources of contamination at IBW-South; further discussion of those issues would not affect the selection of the groundwater remedy in this ROD for IBW-South. See Responses to Prestige Cleaners & Arizona Jacobson Co.'s Comments No. 1.0 and 2.2. EPA's evaluation of source and groundwater information has enabled EPA to issue general notices specific to groundwater to six facilities, as well as parties associated with them. In sum, such source information is addressed in the FS sufficiently for EPA's remedy selection and the modeling supporting it.
09-1	Isoconcentration maps for chemicals in the aquifer have not been provided by CH2MHill. In a dynamic aquifer system like the one under investigation, these maps graphically depict concentration trends over time. If a plume is expanding, isoconcentration maps will identify the magnitude of expansion. Simple multiplication of the time between observation rounds will render the plume expansion rate. Rather than applying general scientific methods based on actual data, CH2MHill projects plume expansion through the use of its numerical model. Figures 3-4 through 3-6 serve as the authors' opinion of the total plumes. Data used for these figures apparently was from July 1994. Such historical maps are useful only as comparisons to current conditions and as a data point to construct plume reduction rates.	The plume expansion cannot be defined when the downgradient extent of the contamination is not known. The omission of the isoconcentration maps does not change the validity of the data analysis and remedy selection. Additional data were reviewed and presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. See response to Prestige Cleaners & Arizona Jacobson Co. Comments No. 2.4 and 3.2.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
10-0	To graphically illustrate the importance of temporal and spatial variability, star plots for all UAU wells are shown. The graphics demonstrate the significant and continuous improvement in water quality. The graphics also indicated that many of the low values reported (i.e., those above detection but below the MCL) occur erratically. On the other hand, several of the relatively elevated locations persist, but even these diminish in size (concentration) with time. It is also apparent from the star plots that the majority of wells under observation contain concentrations of COCs that are diffusion limited, and as such are subject to erratic permutations as they approach non-detectable levels. If the results of CH2MHill's projections are inserted into the actual water quality profile in each plume, and back calculated to 1991, the plumes would have to be spatially over 4 times larger than they are at present. It is clearly evident that the concentration of PCE is steadily declining with time. This observation indicates that the secondary sources have been removed and that existing PCE is dispersing steadily. TCE concentrations in Western plume well SIBW-5U have declined from 540 µg/l to less than 30 µg/l in 1996 according to the text at page 3-9. Inexplicably, CH2MHill does not discuss the significance of a 94% decline in TCE and (60% decline from 1994 to 1996). Similar dramatic concentration declines in each of the plumes is consistently observed but no discussion is offered whether water quality trend analysis was used. It is evident that the risk assessment did not use water quality trend analysis to predict future concentrations absent remediation. CH2MHill should provide their scientific reasoning for ignoring obvious water quality improvements that have a material effect on decision analysis. Continuous declines in TCE concentrations are reported at IMC Magnetics at page 3-9. Source area well SIBW-3U has declined in TCE concentration by over 30 percent in the period between 1994 to 1996. At page 3-10 CH2MHill mentions the Eastern plume source area well SIBW-51U declines in PCE concentration by 65% over 1994-1996. It is evident there is a clear pattern of contaminant decline by contaminant type and by plume. Our investigation of numerous wells in the aquifer clearly shows the water quality is steadily improving in all three plume areas. CH2MHill should apply all water quality data available through July 1997 in an effort to fairly represent the state of these contaminant plumes.	The chemical concentration trends, and some factors, such as the change in water levels which may influence them, are discussed in Section 6 of the RI. The number and variability of these possibly controlling factors that may occur at any particular well is discussed. The influences that a combination of these factors may have on affecting groundwater quality at a particular well are difficult to quantify. In addition to the information presented in the RI, time series concentration plots were presented using data through October 1997, in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. There are several wells at which concentrations are increasing, and the downgradient extent of contamination is not defined. The reviewer is making biased conclusions using only selected data. The issue of contaminant migration is ignored by this reviewer. See responses to previous comments by Unitog Rental Services Corporation-Mr. Kuhlmeier. Concerning data used in the FS and risk assessment, see response to Unitog Rental Services Corporation's Comment No. 09-1 and comments referred to therein; Prestige Cleaners & Arizona Jacobson, Inc.'s Comments No. 3.1 and 3.4; and IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-5.0. EPA has relied on updated data and modeling, presented in the August 12, 1998, technical memorandum in selecting the remedy in this ROD.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
11-0	CH2MHill has routinely used outdated water quality data in the FS. It is a critical flaw in the risk assessment. Water quality data has been collected by both EPA contractors and PRPs through July 1997, a month before the FS was published. CH2MHill ignored these recent rounds of water quality data throughout the FS and associated risk assessment. CH2MHill describes contamination within the MAU at page 3-10 using 1994 data. Data that is three years old is of no utility when there is a great deal of more recent data available. The method of analysis used by the FS authors is critically flawed and inconsistent with the NCP.	It was administratively necessary to have a cutoff date in order to complete data review and analysis and the preparation of the risk assessment and FS. Updated data and modeling based on those data have been distributed to the commentor and entered into the Administrative Record. More recent data and modeling did not alter conclusions reached in the RI/FS, but did add support for adoption of MNA as an expanded part of the remedy for the central and eastern UAU contaminant areas. The method used in the FS is not critically flawed and is not inconsistent with the NCP.
11-1	In constructing a flow model, calibration is accomplished with early time data and validated with later time data. However, neither of these data sets or model results are presented in the RI or FS, contrary to standard procedures as specified by EPA.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration, and supplements the FS. This document is in the Administrative Record. EPA's work is consistent with standard procedures.
11-2	The existing ground water model created by CH2MHill uses the code Micro-Fem. It supports the numerical simulation of steady-state flow in confined, unconfined, and leaky aquifers. In addition, it allows a very large number of nodes, a requirement particular to large sites such as this one. However, it does not contain or link directly to a contaminant transport code, which leads to a severe shortcoming in the CH2MHill approach. Most investigators would have used the USGS MODFLOW code which couples directly with MT3D for a site of this size and complexity. The EPA should give serious consideration to constructing a multilayer, aquifer parameter variable, regional model using MODFLOW.	The results of the groundwater flow model were imported directly into the solute transport model. The results from the MicroFem flow model do link directly with the solute transport model. The selection of the specific code was appropriate at the time the FS was prepared. The use of a different code would not affect EPA's selected remedy. In the future, different codes could be used, if appropriate. MicroFem is much more user-friendly, which allows many more evaluations to be performed than MODFLOW given the same amount of time. The three-dimensional particle-tracking capability allows capture zone evaluations to be performed much more efficiently than with MODFLOW.
11-3	According to the information supplied in Appendix E of the FS, a lengthy calibration procedure was followed in order to have four aquifers interconnected. However, no calibration data is presented in the FS. At minimum, a plot of predicted vs. observed heads should have been presented. The results of the sensitivity analysis are not presented either. The sensitivity analysis dealt primarily with vertical leakage between model layers and the flux boundaries. The effect of parameters such as porosity and hydraulic conductivity, which can have very large effect on the results, do not seem to have been examined. Thus, there is no way to judge the appropriateness or the accuracy of the results. Some of the parameters adopted seem questionable.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding model calibration. The FS did present a discussion of the sensitivity analyses performed on longitudinal dispersion and on the boundary condition at the river.
11-4	Any and all output used for engineering purposes is without adequate scientific foundation. Despite Micro-Fem's capability to consider aquifer heterogeneity, CH2MHill used a constant set of parameters for each of the four layers. To assume homogeneity within each layer over a 15 square mile area consisting of 5,867 model nodes is not credible. Such a model is indicative of only broad scale phenomena such as average transmissivity and vertical gradients. The adopted node spacing of between 200 and 500 feet, when coupled with the assumption of homogeneity, precludes the use of this model for remedial pumping design.	The transmissivity distribution was revised in the updated model presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. This technical memorandum provides additional information regarding model calibration. The model was not being used for remedial design, but for a feasibility study. The node spacing was sufficient for estimating the number of extraction wells, location, and approximate flow rates to capture the given target volumes.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
12-0	The application of this model, Chem Path, is flawed and heavily biased (as is the flow model) for maximum conservativeness. That is, the two models in conjunction maximize the prediction of the chemical concentration at a potential down gradient receptor. Maximization occurs because in all cases, the value for model input parameter was chosen such that it produced the maximum migration distance.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, explains the initial concentration distributions that were used and provides the data on which these initial concentrations were based. The input parameters were not chosen to produce the maximum migration distance. Rather, the input parameters were selected using the data available. The impact of changing these values and boundary conditions was evaluated and considered when comparing the alternatives.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

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12-1	CH2MHill assumed a constant source for the entire 30 years of the simulations and a constant source concentration of 60 µg/l for PCE. This value is more than twice the highest observed concentration anywhere in the aquifer. Obviously, the concentration of PCE will not be constant for 30 years, nor even a single year. In addition, two processes that would reduce the expected concentrations were neglected completely. These are transverse dispersion and degradation. Transverse dispersion always occurs, and its exclusion while including longitudinal dispersion is inexplicable. Similarly, vertical dispersion is also significant in this aquifer as evidenced by the vertical gradients the FS authors note as being "large". A path analysis program such as Chem Path also fails to consider the fundamental chemistry involved in the retardation of the chemical movement relative to the ground water. The retardation factor was used by CH2MHill to show the chemical migration. However, CH2MHill failed to recognize that the mechanism behind such retardation is the partitioning of a chemical between the ground water and that adsorbed to the solid phase. This adsorption is only partially reversible and results in a diminution of mass in the dissolved phase with time and distance. It also represents one of the primary mechanisms which results in random diffusion action between the bulk aquifer matrix and the immobile aquifer matrix. In summary, modeling performed by CH2MHill is scientifically unsupportable, and in no way reflects the actual conditions in the aquifer, nor does the chemical transport model accurately simulate COC movement within ground water. Three analytical models were applied to the data set used by CH2MHill to illustrate the inaccuracies of their conclusions and to provide support to the observational trend analysis. Analytical tools used include, (1) the Complete Mix Model to demonstrate the influence of recharge events, (2) 2-dimensional dispersion calculations that quantify the influence of transverse dispersion and, infer the importance of vertical dispersion and recharge influenced flow direction changes, and (3) BIOSCREEN, an EPA 2-dimensional model. The BIOSCREEN numerical simulations unequivocally show that natural attenuation is a viable remedial alternative. Depending upon the exact set of parameters adopted, the time to achieve MCL for PCE at a distance of 500 feet down gradient from the source, ranges from 3 to 30 years. The most likely estimate derived from Scenario 5, which agrees with the field data at SIBW-51U, is that the plume will be attenuated in approximately 3 years. Water quality data in SIBW-51U has improved from 59 µg/l PCE in 12994 to 4 µg/l in July, 1997. This mass loss rate is more than double that simulated by BIOSCREEN. Using the EPA parameter values, but allowing for transverse dispersion and a finite source (with the EPA mass estimate), the BIOSCREEN simulation indicates that the plume is attenuated in less than 4 years.	The Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provides additional information regarding the input parameters for the solute transport model. A constant source was not used. Rather, an initial concentration was specified for a given area. A concentration of 60 ppb was not used anywhere in the model. The modeling approach did not include biodegradation because this process is not occurring over a widespread area within the contaminant areas, and it is not nearly as significant as dilution and dispersion. EPA's modeling is scientifically supportable, and EPA rejects the commentor's assertions to the contrary. Concerning BIOSCREEN, please see response to IMC Magnetics Corp.-Mr. Hudson's Comments No. 4-6.0 and 6-4.0 Unitog has presented model results since these comments were submitted. The more recent modeling results conflict significantly with the statements in this comment. Specifically, the statement that the plume is attenuated in less than 4 years is very different from the more recent MODFLOW/MT3D modeling results presented by Unitog. The results of Unitog's MODFLOW/MT3D modeling appear to be more in line with EPA's revised modeling results presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998.

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16-0	EPA has commingled three distinct chlorinated solvent plumes into one Superfund site. Neither the RI nor the FS give any indication as to why these plumes are considered codependent by EPA. The distinguishability of three separate ground water plumes within the Indian Bend Wash-South Superfund site cannot be disputed. Spatially, there is up to two miles of separation between the western and eastern plumes. Chemical signatures from source areas defined by CH2MHill are distinct as well. This condition is particularly true between the Eastern plume and the Central and Western Plumes. Whereas the Eastern plume is comprised almost exclusively of PCE, the other two plume's signature COC is TCE. Each plume can be addressed independently from an engineering perspective. In fact, the orientation of wells proposed by CH2MHill is designed to treat water from each plume separately. The only potential savings that may be enjoyed by linking any of these plumes together would be shared piping costs to transfer water to the Salt River. This synergy is only applicable to the Central/Eastern plume combination. Because it is our opinion that active remediation is ineffective and cost prohibitive, there are no potential engineering reasons for linking any of these plumes together in a single ROD. Linkage of any of the three plumes can only be attributed to convenience for the EPA, or alternatively, as a mechanism to enjoin otherwise not responsible parties in contribution for defunct Potentially Responsible Parties (PRPs).	The boundaries of the contaminant areas are estimated based on data gathered from existing monitoring wells during the RI/FS process. An insufficient number of wells located between the estimated plume boundaries has existed to establish that the contamination was not connected or had not commingled in some areas. Further data analysis is warranted. EPA denies the commentor's speculation that EPA is seeking to involve PRPs unfairly.
18-0	The risk assessment does not provide an analysis of the actual and potential risks to human health and the environment potentially associated with the Site. Although CH2MHill demonstrate their apparent knowledge of the requirements for a baseline risk assessment, by their own admission the "Groundwater Risk Assessment" is in fact not a risk assessment. For this reason, the "Groundwater Risk Assessment" performed by CH2MHill does not conform to the NCP.	The baseline risk assessment complies with the NCP, and it addresses the potential for risk in the absence of remedial action. Please see responses to Arizona Public Service-Mr. Oliver's Comment No. FS2.3 and IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-1.0. Neither EPA nor its contractor, CH2M HILL, has admitted that the baseline risk assessment is in fact not a risk assessment.

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18-1	The discussion of the uncertainties in analyzing risks from PCE and TCE provided in the "Groundwater Risk Assessment" is inadequate and fails to provide meaningful context to the risk calculations presented in the report. In particular, the authors entirely ignore the interim, provisional status of the slope factors used to calculate theoretical lifetime cancer risks posed by PCE and TCE. Furthermore, the uncertainties section of the report vaguely discusses epidemiological literature concerning human exposure to trihalomethanes. Because neither tetrachloroethene nor trichloroethene are trihalomethanes, the discussion of the human health risk associated with trihalomethane exposure is irrelevant. Commonly available sources of toxicological information such as the Agency for Toxic Substances and Disease Registry Toxicological Profiles for TCE and PCE provide much better summaries of the uncertainties associated with assessing potential human cancer risks from exposure to these chemicals.	The uncertainties discussion tries to place the numerical health risks in perspective with known human exposures to reasonably similar chemicals (mutagenic chlorinated VOCs that are carcinogenic in laboratory animals). While TCE and PCE are not trihalomethanes, they share some similarities with trihalomethanes in terms of the types of toxic responses. All of these chlorinated VOCs (TCE, PCE and trihalomethanes) are mutagenic in bacterial test systems and are carcinogenic in laboratory animals. While there is evidence that these substances are carcinogenic in laboratory animals, epidemiological studies in humans are equivocal, and do not clearly indicate evidence of carcinogenicity for these substances. The epidemiological discussion points to the fact that it is difficult to know the potential for human health risks at low level exposures, which results in risk assessments being used to evaluate this exposure situation. EPA agrees that provisional slope factors create uncertainties in the estimated risks; however, these values will continue to be used while revised values are under development by the National Center for Environmental Assessment. Toxicological profiles for PCE and TCE by ATSDR provide similar conclusions for these chemicals in groundwater, as discussed in the uncertainties section (i.e., it is difficult to determine the potential for groundwater contamination to pose a human health risk). Note that ATSDR has established an exposure subregistry for TCE exposures in groundwater, which indicates an increased level of concern about that chemical.
18-2	Comment re: Section 4.1.6 of the FS. This section indicates that "The adverse health effect of principle concern for groundwater contamination is cancer." Lifetime cancer risks are calculated using a "sample-specific risk assessment methodology" and the authors claim this methodology "represent only a small modification of current risk assessment guidelines". These risk calculations are termed "total increased lifetime cancer risk" or "ILCR". As calculated using the "sample-specific risk assessment method", single ground water samples represent an exposure point. Despite the authors' claim, this methodology is a significant modification of current risk assessment guidelines, so significant in fact that their analysis cannot be properly called a "risk assessment" under the NCP. The objectives of the "sample-specific risk assessment methodology" used in the FS and the baseline risk assessment methodology described in EPA guidance are quite different. In fact, the objectives of the "sample-specific risk assessment methodology" used in the FS are so different from the objectives stated in EPA guidance that the use of the term "risk assessment" in the term "sample-specific risk assessment methodology" is inappropriate. While the "sample-specific risk assessment methodology" calculates lifetime cancer risks for samples, no attempt is made to calculate lifetime cancer risks for human receptors. Thus the endpoint of the baseline risk assessment is an estimate of human health risk.	We note that the commentor uses a general criticism of risk assessment (that risk assessments generally project hypothetical risks based on sampling data) to imply that the risk assessment performed for IBW-South groundwater is inappropriate. The sample-specific methodology provides a better spatial evaluation of potential risks (under the assumption, which is consistent with EPA guidelines, that groundwater in the entire area is usable) than developing point estimates of reasonable maximum exposure point concentrations. Neither EPA guidelines for risk assessment nor the NCP precludes use of the sample-specific methodology for calculating exposure point concentrations.

No.	Comment	Response
20-0	According to EPA guidance, the stated goal of the risk assessment is to "characterize the expected risk to human health or the environment" while the stated goal of the "sample-specific risk assessment" presented in the FS is to characterize "the nature and extent of ground water contamination". For this reason, it is inappropriate to use the term "risk assessment" to describe the procedure used in the FS. Furthermore, the stated objective of the baseline risk assessment to "provide risk managers with an understanding of the actual or potential risks to human health posed by a site" is not achieved by the "sample-specific risk assessment methodology."	The sample-specific methodology characterized "health risks associated with each sample," thus facilitating the identification of "areas of groundwater that could pose unacceptable health risk should that water be used in the future." Groundwater Risk Assessment, Section A2.6, at page A-5. Thus, the risk assessment characterized risks at or posed by IBW-South in order to provide such information to the risk managers, and the term "risk assessment" is appropriate for it. See response to previous comment and IMC Magnetics Corp-Mr. Hudson's Comment No. 6-1.0.
20-1	Risks cannot be ascribed to ground water samples. Apart from its possible value as a relative toxicity/carcinogenicity screening procedure, the "sample-specific risk assessment methodology" is a confusing, technically inaccurate presentation of the risks potentially associated with exposure to chemicals in ground water. The screening procedure conducted in the FS could as easily have been conducted by calculating the ratio of the detected chemical concentration in ground water to the maximum contaminant level (MCL). The "sample-specific risk assessment methodology" used by CH2MHill is inconsistent with EPA guidance for conducting the exposure assessment portion of a baseline risk assessment. The FS violates the intent of RAGS and EPA Guidelines for Carcinogen Risk Assessment by assessing risks from exposure to single ground water samples. The results of the "sample-specific risk assessment methodology" are therefore meaningless when viewed in terms of the RAGS requirement to determine exposure concentrations over a 30-year exposure period considered in the FS.	In addition to characterizing risks to human health posed by the site, the risk assessment methodology presented in the FS had the dual purpose of determining if the No-Action Alternative is protective as required under the NCP, and for the purposes of identifying areas where concentrations in groundwater could exceed risk thresholds that trigger remedial action. While risk estimates were calculated for groundwater concentrations reported in individual samples, they were also calculated for multiple concentrations collected over time from monitoring wells. Therefore, the risk estimates provided estimates of changes in risks over the time period covered by groundwater monitoring data. Selection of the assumptions used to project health risks from the groundwater data was consistent with the methods described in EPA's Risk Assessment Guidance for Superfund. See also response to Unitog Rental Services Corporation's Comment No. 18-2. Calculation of ratios of concentrations to MCLs would be inappropriate because MCLs include considerations of control technologies and detection limits in addition to health risk considerations. MCLGs are health-based, but would not be suitable for carcinogenic contaminants, because MCLGs for carcinogens are set at zero.
21-0	As discussed in other sections of these comments, the "sample-specific risk assessment methodology" also ignores the current trend of decreasing PCE and TCE concentrations with time. The trend of declining concentrations of PCE and TCE in time will profoundly affect estimates of risk that are based on hypothetical future use of ground water over the next 30 years. By ignoring this trend and by failing to project concentrations of PCE and TCE that may be contacted in the future, the "sample-specific risk assessment methodology" used in the FS fails to follow EPA guidance that calls for estimation of the concentrations of chemicals that will be contacted over the period of exposure. By estimating the risk associated with contact with chemicals detected in a single ground water sample, the FS violates the intent of RAGS--that is, the assessor should determine a realistic estimate of future chemical exposure.	An assumption in the risk assessment is one of steady-state contaminant concentrations in groundwater over time. This is consistent with EPA guidance. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-4.0. The risk assessment also recognizes that, in the absence of site-specific information, there is an equal probability of exposure at any point within the contaminant plume at any given time in the future. This is appropriate for a "baseline" risk assessment, which is supposed to assume no regulatory controls and no remedial action. See response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-2.2 and Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 20-1.

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23-0	Although a discussion of uncertainties is regarded as a meaningful and necessary part of a baseline risk assessment, the "Groundwater Risk Assessment" fails to provide worthwhile discussion of important risk assessment uncertainties. For example, while the authors provide a description of the EPA weight-of-evidence classification system for carcinogenicity in Table A-8 of the report, they fail to discuss the weight-of-evidence classification for PCE or TCE. In fact, the EPA currently does not officially classify PCE or TCE as chemical carcinogens on its IRIS database or its secondary source of slope factors or reference doses known collectively as the Health Effects Assessment Summary Tables (HEAST). The EPA weight-of-evidence classifications for PCE and TCE were withdrawn from the IRIS database several years ago and are also not listed in the HEAST. For these reasons, the sources of the slope factors for PCE and TCE cannot be IRIS or HEAST as mentioned in the "Groundwater Risk Assessment". Instead, the slope factors for PCE and TCE are obtained from the Superfund Health Risk Technical Support Center, thereby identifying the slope factors for these chemicals as the most provisional toxicology data allowed for use in risk assessments. This fact is unstated in the "Groundwater Risk Assessment", implying greater EPA confidence in the provisional slope factors for PCE and TCE than currently exists. Because the lifetime cancer risks calculated for PCE and TCE rely on these highly provisional slope factors, the calculated cancer risks must therefore be considered highly provisional and uncertain.	Consideration of the impact of using provisional toxicity factors is best applied during evaluation of risk management alternatives. EPA periodically reviews the toxicology data used to develop slope factors and reference doses. A review of the IRIS file for TCE, for example, indicates that a new carcinogen summary is in preparation by the Carcinogen Risk Assessment Verification Endeavor (CRAVE) workgroup. It would be inappropriate to disregard toxicity information for TCE and PCE while new information is under review. While TCE and PCE are not trihalomethanes, they share some similarities with trihalomethanes in terms of the types of toxic responses. All of these chlorinated VOCs (TCE, PCE and trihalomethanes) are mutagenic in bacterial test systems and are carcinogenic in laboratory animals. While there is evidence that these substances are carcinogenic in laboratory animals, epidemiological studies in humans are equivocal, and do not clearly indicate evidence of carcinogenicity for these substances. EPA agrees that the source of the slope factors should be listed as the Superfund Health Risk Technical Support Center, and that reliance on provisional slope factors potentially creates uncertainties in the estimated lifetime cancer risks. The risk assessment already acknowledges that use of slope factors in general results in an overstatement of risks and it would be inappropriate to disregard existing evidence for human carcinogenicity of TCE and PCE while these substances are under review by CRAVE. See response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 20-1.

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23-1	The authors of the "Groundwater Risk Assessment" inexplicitly choose to discuss human epidemiology studies of the cancer risks associated with exposure to trihalomethanes, "VOCs", carbon tetrachloride, and chloroform. No discussion is presented regarding the human carcinogenicity of PCE and TCE. The authors admit that "The human experience with exposure to ground water contaminant concentrations suggests that a low likelihood exists of a perceptible association between adverse health effects and ground water contamination at IBW-South". We would agree. As stated above, the "sample-specific risk assessment" conducted by CH2MHill for the Indian Bend Wash-South (IBW-S) cannot be considered a baseline risk assessment as it is defined by the NCP and EPA guidance. The principal technical flaw in the "sample-specific risk assessment methodology" is its attempt to attribute lifetime cancer risk to ground water samples rather than future potentially exposed persons. The "sample-specific risk assessment methodology" provides no legitimate long-term estimate of human exposure to chemicals detected in ground water. As quoted above from EPA guidance, such an exposure estimate is necessary to quantitatively estimate lifetime cancer risk. EPA risk assessment guidance regarding estimating exposure to chemicals in ground water is quite clear. For example, RAGS states that: "Ground-water monitoring data are often of limited use for evaluating long-term exposure concentrations because they are generally representative of current site conditions and not long-term trends. Therefore, ground-water models may be needed to estimate exposure concentrations. Monitoring data should be used when possible to calibrate models." and "If ground-water modeling is not used, current concentrations can be used to represent future concentrations in ground water assuming steady-state conditions. This assumption should be noted in the exposure assessment chapter and in the uncertainties and conclusions of the risk assessment." Owing to the fundamental technical flaws in the "sample-specific risk assessment methodology", a revised characterization of lifetime cancer risk due to exposure to PCE and TCE is needed for the IBW-S site.	Information provided on the uncertainty associated with toxicity values or potential for adverse health effects related to trihalomethane exposure is presented to allow the risk manager adequate information to interpret the results of the risk assessment in their proper context. EPA guidance (RAGS Part A) states that current groundwater concentrations can be used to represent future concentrations in groundwater, assuming steady-state conditions. The risk assessment acknowledges that groundwater contaminant concentrations fluctuate over time, leading to fluctuations in risk over time. The risk assessment meets the intent of the NCP and the EPA guidance. See response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comments No. 18-1 and 20-1.

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25-0	Concentrations of PCE and TCE in the Eastern plume are declining with time. This observation indicates that the RAGS assumption of "steady state" concentrations of PCE and TCE in ground water is not valid for Eastern plume ground water. Water quality in Eastern plume wells is improving, the majority of wells are below the MCL for PCE and the remainder are expected to reach the MCL within a short time. Available groundwater monitoring data indicates that half lives of PCE in Eastern plume wells ranges from 0.61 years to 2.14 years. Given a 2.14 year half-life, current Eastern plume PCE concentrations would decline more than 99% over the assumed 30 year exposure period, even with no action. In summary, hypothetical future lifetime cancer risk calculated to be associated with exposure to PCE and TCE in East Plume ground water will be profoundly influenced by the declining concentrations of PCE and TCE with time. The "sample-specific risk assessment methodology" used by CH2MHill is unable to account for this important trend in the estimation of cancer risk associated with hypothetical future exposure. Failure to acknowledge this trend will lead to overly conservative, highly biased estimates of risk from PCE and TCE exposure in the Eastern plume wells.	The data used to estimate the potential for risk from groundwater exposure represent a snapshot of concentration trends taken over time. Information regarding the trends was incorporated by presenting the time series plots showing the ILCR versus sample date. This information shows that the risks trend both up and down over time, and no steady decline in risk is evident. Further, there are no definitive methods available that allow quantification of degradation rates for mixtures of chemicals. At best, degradation rates for individual chemicals could be considered, but degradation rates for chemical mixtures have not been quantified. The uncertainty associated with quantifying the potential for contaminant degradation would preclude useful interpretation of the results. Accordingly, the risk assessment is not biased. See also responses to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comments No. 18.2, 20.0, and 21.0.
25-1	Concentrations of PCE and TCE are generally declining in Eastern plume ground water. However, PCE concentrations in three Eastern plume wells have remained low but fairly constant over the monitoring period. According to RAGS, steady state conditions may be assumed for PCE concentrations in wells SIBW-10U, -39U, and -50U. This assumption is clearly conservative in view of the declining PCE concentrations in the majority of wells in the Eastern plume. The calculated lifetime cancer risks associated with exposure to PCE and TCE in ground water in Eastern plume wells SIBW-10U, -39U, and -50U are within the 1 x 10-4 to 1 x 10-6 lifetime cancer risk level specified in the NCP. Furthermore, calculated risks are minimally above the lifetime cancer risk associated with exposure to ground water containing the MCL concentrations of PCE and TCE. Mitigating concern over the acceptable levels of lifetime cancer risk associated with these wells is the fact that there is no current direct exposure to the chemicals of concern in ground water at these locations.	The risk assessment assumed future use of groundwater regardless of location within the contaminant plume. The commentor only addresses groundwater contaminant trends selectively, and thus does not provide adequate "baseline" information for consideration in the evaluation of alternatives. See response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comments No. 20-1 and 25.0. Future exposure to contaminated groundwater from IBW-South is a realistic scenario. See response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 5-1.0 and IMC Magnetics Corp.-Mr. Hudson's Comments No. 6-4.0 and 6-5.2.
26-0	Based on our review of the "Groundwater Risk Assessment" and current EPA guidance for conducting baseline risk assessments, we conclude that the CH2MHill assessment fails to meet EPA objectives for a baseline risk assessment. It thus provides no meaningful information for assessing future risk to hypothetical ground water users and therefore, no information for assessing the relative effectiveness of various remedial alternatives.	The baseline risk assessment does meet EPA objectives: it addresses the potential for risk in the absence of remedial action, and therefore is useful in evaluating a variety of remedial alternatives. It is also useful in delineating locations where active remedial measures are necessary. See response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 20-1.

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28-0	The FS mentions in Section 4.1.6 that action is not required for risks falling between 10-4 and 10-6. Unfortunately there is no discussion why CH2MHill has determined it is reasonable and cost effective to aggressively treat trace concentrations of COCs that all evidence points to natural cleansing within a few years. This overwhelming evidence, is coupled with the lack of any exposed population draws into serious question the utility of performing active remediation at any one of the three sites. Once again, CH2MHill should provide substantive technical and risk based evidence to support the conclusion that extracting 8 mgd from this aquifer is justified.	The NCP outlines that action will be taken for risks above 10-4 and that action may be taken for risks falling between 10-4 and 10-6, as EPA determines on a case-by-case basis. The determining factor for remedial action at IBW-South is the chemical-specific ARARs, especially the SDWA MCL standards, and the NCP's expectation to restore groundwater to its beneficial uses as a drinking water. Please see responses to IMC Magnetics Corp.-Mr. Hudson's Comments No. 6-1.0 and 6-1.1, and IMC Magnetics Corp.-Mr. Jenkins' Comment No. 01.0. Remedial action is warranted at IBW-South based on current and potential risks posed by the site. Active remedial action - extraction and treatment - is necessary at the western contaminant area in order to meet remedial action objectives within a reasonable time frame. Moreover, the amounts of contaminants are well above trace levels at all contaminated areas and would likely pose health risks if the groundwater were used as drinking water.
28-1	Comment re: Section 5.0 of the FS. Within this section, CH2MHill states that according to the results of the Baseline Risk Assessment, exposure to contaminated ground water might in the future pose levels of risk considered unacceptable under the NCP. The NCP, specifically section 40 CFR 300.430(e)(2)(I)(A)(2), states that "acceptable exposure levels are generally concentration levels that represent an excess upper bound life-time cancer risk to an individual of between 10-4 and 10-6. CH2MHill's statement that its risk assessment identified levels of unacceptable risk is misleading and incorrect.	As noted in the risk assessment, the increased lifetime cancer risk potentially associated with exposure to 1,2-dibromoethane and benzene is estimated to be greater than 1 x 10-4. This risk level is outside of the acceptable risk range noted by the commentor. See also response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 28-0, and comments referenced therein.
28-2	Comment re: Section 4 of the FS. In this section, specifically Figures 4-2 and 4-3, present the total ILCRs for samples collected from the UAU and MAU/LAU during April 1995. The data presented on these figures do not indicate any ILCR greater than 2.1x10-5. In addition, Table A-19 of the FS, presents a summary of total ILCR for samples collected from the UAU, MAU and LAU in April 1994 and April 1995. The highest risk factor presented in this table of 3.87x10-5 is found in the Western plume. The well associated with the highest ILCR (SIBW-5U) in 1994 had an ILCR of 9.6x10-6 in 1995, thus demonstrating that the anticipated future risk will be even less.	Time series plots of ILCR versus time indicate that the risks increase and decrease over time, with no clear trend up or down. As some groundwater concentrations may decrease at specific locations, other locations may exhibit an increase in contaminant concentration. See response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 20-1.
28-3	Comment re: Section 3.2.2.1 of the FS. CH2MHill states that COC concentrations in the Western plume area "have notably decreased in SIBW-5U and other UAU wells down gradient of SIBW-5U". For the Central plume area, CH2MHill states that the "since 1992, the TCE concentrations have decreased in these wells". For the Eastern plume area, CH2MHill states "since 1994, the PCE concentrations have notably decreased in SIBW-51U...". Based on these results and FS statements of decreasing COC concentrations over time, it is unclear how the statement regarding acceptable future risk at this Site could have been made.	EPA guidance (RAGS Part A) notes that current groundwater concentrations can be used to represent future concentrations in groundwater, assuming steady-state conditions. The risk assessment acknowledges that groundwater contaminant concentrations fluctuate over time, leading to fluctuations in risk over time. See responses to Unitog Rental Services Corporation Comments No. 28-1 and 28-2, IMC Magnetics Corp.-Mr. Hudson's Comment No. 6-3.2, and IMC Magnetics Corp.-Mr. Jenkins' Comment No. 01.6. EPA has selected a remedy that addresses the changing VOC concentrations in groundwater and the risk associated with those concentrations, and will restore the groundwater throughout the site to concentrations that will allow unlimited use within a reasonable time frame.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

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28-4	Comment re: Page 5-5 of the FS. The authors err when they claim the target volume does not change significantly when "more recent" data are incorporated. In fact, our review of water quality data indicates just the opposite. Current ground water quality data (1997) clearly indicates a shrinking target volume, based on ILCR values. As a practical matter, a target volume in the Eastern and Central plumes does not exist, and the potential target volume in the Western plume continues to decline in magnitude.	The commentor is correct that when all data collected through 1997 are included, the extent of the regional target volume does change significantly. The statement in the FS was written much earlier in time than when all of the 1997 data became available, and referred to earlier data. EPA has adjusted its proposed remedy to include these additional data in making the final remedy selection.
29-0	Comment re: Section 5.4 of the FS. Within this section, CH2MHill attempts to determine target volumes of ground water for evaluating ground water extraction alternatives. Table 5-1 and 5-2 of the FS provide results of aquifer volume determination and resulting mass of TCE and PCE in the aquifer. No supporting data such as plume dimensions, zone of water column impacted, or concentration of COCs was provided to demonstrate how these conclusions were reached. Without this supporting data it is impossible to ascertain the accuracy of the FS calculations. However, the results presented in the FS clearly demonstrate that there is very little to insignificant mass of COCs in ground water.	The target volumes were calculated using the area of contamination and the depth of the aquifer. Sections 3.1.1.1 and 3.1.1.2 of the FS present the depths of the UAU and MAU, respectively. In Section 5.4.1 and 5.4.2, the area for the regional target volume containing contaminants "above the MCL of 5 µg/L" is discussed. In general, the area of the partial target volume corresponded to "areas in which risk exceeded 1x10-5, and where TCE and/or PCE concentrations exceeded 20 to 30 µg/L," or the "highest contaminated areas" and represented a volume, when combined with MNA, would meet remedial action objectives of cleanup to MCLs in a reasonable time frame with limited migration. The data supporting these estimates of the areas of contamination are summarized in the FS, are available in the Administrative Record for review, and include the contaminant concentrations that are discussed extensively in the FS.
29-1	By back calculating, it is assumed that an average COC concentration of 9 ppb was used to arrive at the estimates of mass in the aquifer. No differentiation was made between the Eastern plume and the rest of the site.	The mass estimates were performed assuming a distribution of concentrations throughout each plume. Each plume was differentiated. The text did not imply that an average COC concentration was used.
29-2	Comment re: Section 5.4.2 of the FS. The FS established criteria for determination of partial target volumes. CH2MHill claimed these criteria included areas in which risk exceeded 1x10-5, and where TCE and PCE concentrations exceeded 20 to 30 µg/l. Based on these criteria, CH2MHill inappropriately identified a partial target volume for the Eastern plume area, because risk does not exceed 1x10-5 at any location, nor does the concentration of PCE exceed 20 to 30 µg/l. Based on CH2MHill's own criteria stated in section 5.4.2, the Eastern plume area should not have a partial target volume, and therefore, should not be included within the EPA proposed remedial alternative.	As stated in Section 5.4.2, the partial target volumes focused remediation on the portions of the plume containing the highest contaminant concentrations. The partial target volumes generally corresponded to areas where risk exceeded 1x10-5 and TCE and/or PCE concentrations exceeded 20 to 30 µg/L. As explained in the Proposed Plan, EPA always conceived that the target volumes of groundwater to be extracted would be determined during remedial design based on the most current data and analysis of contaminant distribution at IBW-South. Portions of the eastern contaminant areas belonged in the partial target volume, as depicted in the Proposed Plan. Since that time, and partially in response to PRP comments, EPA re-analyzed additional data and modeling, as set forth in the Technical Memorandum re "Documentation of Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. EPA has, based on that new data analysis, determined in this ROD for IBW-South that the central contaminant area no longer falls within the partial target volume for extraction and treatment, but rather, will be remediated by MNA (or the contingency remedy of extraction and treatment if MNA is insufficiently effective).

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
29-3	This evaluation used ground water data that is three years old. CH2MHill failed to consider more recent ground water COC data in their evaluation. Even when using the old ground water data, CH2MHill states that there is only 105 kg of COC in the ground water at this Site. This is a very low mass of contaminants spread over 15 mi2. These factors make ground water extraction and treatment a very low efficiency and high cost remedy for this Site. The FS authors contend in Section 5.4.2 that EPA's objective in developing the partial target volumes is to include alternatives that could potentially meet the Remedial Action Objectives (RAOs) within a reasonable time. However, information provided in Table 8-2 indicate the alternatives proposed for addressing these target volumes will require 30-50 years to meet the RAOs. Water quality data does not support the notion that this aquifer will require even 20 percent of this time frame, with a no action alternative. It is evident that all estimates made by CH2MHill are seriously flawed, due largely to an incorrect assumption that COC mass can be continuously removed from the aquifer skeleton for many years.	It was administratively necessary to have a data cutoff date to complete review and analysis and prepare the RI. The mass estimates were not updated when more recent water quality data were reviewed. This was not required for the FS because it does not significantly affect the comparison of alternatives. EPA considered data through February 1996 in establishing the partial target volumes in the FS, but did not revise those volumes according to the 1996 data for these administrative reasons, and because as the Proposed Plan stated, the partial target volumes would need to be further refined during the remedial design. EPA's six alternatives evaluated and presented in the FS and Proposed Plan consider MNA, (regional) extraction and treatment, and numerous combinations thereof, including extraction and treatment of a "partial" target area combined with MNA. An updated groundwater evaluation was presented in the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998. Based on that updated analysis, EPA has determined that MNA is the most cost-effective remedial action for the central and eastern contaminant areas. However, for the western contaminant area, extraction is necessary in order to contain the plume to prevent its migration an unacceptable distance and to restore that area to MCLs within a reasonable time frame. EPA's updated modeling showed that these two remedial action objectives could not be achieved in the western area without active remedial efforts, regardless of contaminant mass. See response to Arizona Department of Environmental Quality-Ms. Fant Comment No. 1.01. The pump-and-treat system will prevent contaminant migration and will remove contamination. If the aquifer cleanup is not progressing as expected, then adjustments can be made at least every 5 years during the EPA review.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
30-0	Comment re: Section 6.0 of the FS. Within this section, it is stated that there is a universe of potentially applicable technology types and process options available to implement the Ground Water Remedial Alternatives identified for this Site. Even within this so called universe of potential options, the authors do not mention alternatives which address the source of COCs in the ground water. This is a significant error in the identification and screening of potential remedial alternatives. The focus of the FS is solely on ground water containment alternatives. By only considering containment alternatives for ground water restoration and not source remediation at this Site, CH2MHill has ignored one of the general RAOs presented in section 5.1 of the FS for remedial actions at this Site: "Expedite Site cleanup and restoration". This significant flaw in the thought process at this early stage of alternative evaluation also reduces the ability to address one of the specific RAOs presented in section 5.2, which is to "Cost effectively reduce contamination in groundwater..." This also has limited CH2MHill's evaluation of remedial alternatives to only two: natural attenuation, and ground water pump and treat (containment) options.	Sources of VOC contamination at IBW-South are summarized in the RI/FS; they are addressed in detail in EPA's 1993 Record of Decision for VOCs in the Vadose Zone and supporting documents, including PPIs and Focused RIs, which are to be updated in the future. The contaminants in the vadose zone are the sources for the groundwater contamination at IBW-South. Because the vadose zone contamination sources were addressed in the 1993 ROD and supporting documents for that OU, a full evaluation of sources was beyond the scope of the Groundwater OU RI/FS. Significantly, the groundwater remedial alternatives evaluated in the FS and Proposed Plan and summarized in this ROD assumed that the sources of VOCs in the vadose zone were controlled; that is, the analysis considered whether groundwater remediation was necessary and which alternatives were appropriate, assuming no further releases from soils to the groundwater. Under that analysis, EPA concluded that remedial action for IBW-South groundwater is necessary, and that the selected remedy is the most cost-effective. Accordingly, there was no error in the identification and screening of potential alternatives, or any inappropriate limitation of alternatives considered. Likewise, there was no failure to consider the general remedial action objectives cited in the comment which were, in any event, specific to the groundwater OU. See response to Arizona Public Service-Mr. Oliver's Comment No. FS2.2. The 1993 ROD and 1998 ROD combined will address VOC contamination at IBW-South.
30-1	EPA developed a remedial alternative that periodically pumps City of Tempe (COT) municipal well No. 7. As noted at page 2-5, the City of Tempe does not use this well, nor is the city interested in receiving treated water from this well. Numerous backup wells are available outside the vicinity of this Superfund site. The basis for this option is unclear. HILL should provide a rational basis for this option or delete it from the text. Comment re: Section 7.2 of the FS. Within this section, the EPA assembles 11 alternatives. Of these 11, one alternative (Alterative 3) is a limited action which includes well head treatment at COT Well No. 7. It is not clear why this alternative is included due to the statement in section 7.2.3 that "The City of Tempe would not likely use COT No. 7 because other water supply wells are available and preferred sources of drinking water".	The commentor mis-states the text on page 2-5 of the FS, which states that COT uses SRP water and has lost use of groundwater wells because of their contamination. This alternative was presented to allow the City of Tempe the option of using a city well to remediate the groundwater. COT No. 7 was selected as a representative well and because of the available data for proper evaluation in order to permit consideration of an option that allowed COT to use a well in emergencies, employing a wellhead treatment technology. COT has expressed strong interest in groundwater restoration and restoring the wells that have been impacted by the groundwater contamination. See City of Tempe Comment No. 1.0. COT has also said that it cannot rule out the possibility of use of groundwater in emergencies.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
30-2	Of the remaining ten alternatives other than Alternative 3, only three different approaches are considered, including: No action; Natural attenuation; and Ground water pump and treat. Attempts are made to vary the ground water pump and treat option by evaluating different options (Alternatives 4 through 11) for treated water disposal. However, this still results in a very limited evaluation of alternatives. CH2MHill fails to evaluate innovative approaches as required in 40 CFR 300.430(e). Rather they state that "innovative or nonrepresentative processes may be found to offer significant advantages". They imply that these specific processes are typically selected during the Remedial Design (RD) phase of the CERCLA process. By not completely evaluating the "universe" of potentially applicable remedial alternatives, the EPA alternative evaluation process is flawed.	Appendix C of the FS contains the detailed screening of technologies and process options. The technologies and processes were screened in a two-step process. The first step is an initial screening of technologies or processes that are applicable to the site. Figures C-1 lists all the technology options available, including technologies considered innovative. The innovative technologies listed are reactive wall, high-energy electron irradiation, and synthetic resin adsorption. The reactive wall was not appropriate for the site because of the depth and extent of the contamination. The second step compares the final technologies to three criteria. Figure C-2 presents the detailed screening of the final technologies where both high-energy electron irradiation and synthetic resin adsorption were screened out. EPA has appropriately evaluated innovative technologies, consistent with the NCP; the alternative evaluation process is not flawed.
31-0	CH2MHill lists the naturally occurring in-situ mechanisms that attribute to natural attenuation of contamination, but focus their discussion on biological degradation. They mistakenly put too much emphasis on the biological degradation (or lack of) aspect of natural attenuation. For this Site, solute diffusion and dispersion will have a higher degree of impact on COC concentration than biological degradation. CH2MHill does state that solute dilution is an important mechanism and should be considered for this Site, but does not provide sufficient information to allow for a thorough evaluation, or to determine if they included it within their study. Without a thorough evaluation of these other natural attenuation mechanisms, the overall evaluation of natural attenuation is flawed.	Both the FS and the Technical Memorandum re "Documentation of the Indian Bend Wash-South Groundwater Flow and Solute Transport Models," dated August 12, 1998, provide adequate discussions of the role of dilution and dispersion in natural attenuation processes occurring at IBW-South. EPA agrees that dilution and dispersion will have a higher degree of impact on VOCs than will biodegradation. Natural attenuation has been thoroughly evaluated for IBW-South, and the evaluation is not flawed. See response to IMC Magnetics Corp.-Mr. Jenkins' Comment No. 07.0 and IMC Magnetics Corp.-Mr. Hudson's Comment 7-2.1. EPA's selected remedy does incorporate monitored natural attenuation at parts of IBW-South. See response to Arizona Department of Environmental Quality-Ms. Fant's Comment No. 1.01.
31-1	Comment re: Section 8.3.4 of the FS. A ground water model is used to evaluate the ground water pump and treat alternatives. It is not clear if the potential effects of the Town Lake project were considered in the modeling efforts. The location of these proposed ground water extraction wells is less than one mile from the ground water plume areas. The extraction of approximately 28,000 gallons per minute from this shallow aquifer in close proximity to the ground water plumes will undoubtedly have an impact on ground water flow patterns within the area of interest. It appears that this scenario has not been included in the alternative evaluation. Therefore, the accuracy of the ground water extraction modeling and resulting pump and treat alternative evaluation is highly suspect. In addition, in section 3.1.2.1 it is stated ground water flow in the UAU aquifer originates mainly from Salt River recharge during periods of flow. The Town Lake project will significantly reduce the amount of infiltration from the Salt River and thus will reduce water recharge to the UAU. It is unclear if this has been considered with respect to the Town Lake project. If not considered and incorporated into the alternative evaluation, all ground water extraction scenarios for this Site are suspect. For this reason, the conclusions derived in the FS are fatally flawed.	Concerning the influence of Town Lake, please see response to Unitog Rental Services Corporation's Comment No. 05-1. Town Lake's influence was considered along with a range of river recharge scenarios, and the groundwater extraction scenarios are not "suspect." The Town Lake project may reduce the amount of infiltration during a Salt River flow event in some areas, however there will still be significant recharge upstream of Town Lake. Also, the recirculation wells that are a component of the Town Lake project would not necessarily be operating during a flow event.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
32-0	The detailed evaluation of alternatives presented in section 8 of the FS, and specifically in Table 8-2 did not identify any significant differences between alternative 4 and 2 with regards to the CERCLA threshold and primary balancing criteria, with the exception of cost. Present worth costs of Alternative No. 2 for 30 years is estimated at $2.58 million dollars, (note: the costs for Alternative 2 as presented in Table 8-2 are incorrect) while the estimate for Alternative 4 is $28.3 million dollars.	Section 8 of the FS presents the detailed evaluation of each alternative for the CERCLA criteria. Section 9 of the FS presents the detailed comparison of each alternative to the other alternatives for each CERCLA criterion. As shown in Section 9, Alternative 4 complies significantly better with the CERCLA threshold criteria. Under Alternative 2, aquifer cleanup standards would not be met within a reasonable time frame. (Specifically, the western contaminant area would migrate an unacceptable distance and would not be restored to MCLs in a reasonable time frame.) Cost is a significant distinction between Alternatives 4 and 2, but because Alternative 2 is not protective, it cannot be selected. The present worth costs for Alternative 2 presented in Table 8-2 of the FS should have been $1,370,000 for 5 years and $2,580,000 for 30 years.
32.1	Both alternatives 2 and 4 rely on institutional controls to provide protection to human health by preventing the use of the aquifer for human consumption, and both alternatives rely on natural attenuation to address ground water contamination. In addition, both alternatives estimate that ARARs will be met within the same time frame, at least for the Eastern plume area. The estimated time for Alternative 2 to meet ARARs is suspect due to previously identified problems with the groundwater modeling efforts. Alternative 4 does not provide any increase in protection of human health. Therefore, the EPA's selection of this more costly alternative should be reconsidered.	Alternative 4 as presented in the Proposed Plan provided a significant increase in protectiveness over Alternative 2 because Alternative 4, but not Alternative 2, would restore the aquifer to cleanup standards within a reasonable time frame and prevent migration of contamination an unacceptable distance. Based on evaluation of recent data (September 1994 through July 1997), EPA has modified Alternative 4 so that the eastern and central contaminant areas will be restored by MNA, and only the western area will undergo active extraction and treatment. This modification has resulted in a significant decrease in overall costs for Alternative 4. See response to Arizona Department of Environmental Quality-Ms. Fant's Comment No. 1.01.
33-1	Alternative 4, while presenting no identified increase in protection of human health is estimated to cost over 10 times more than alternative 2. As stated in 40 CFR 300.430(e), "Costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at a greater cost, may be eliminated". In selecting alternative 4 over alternative 2, CH2MHill has failed to consider and comply with this section of the NCP. Both alternatives use the same institutional controls, and same approach to treat a significant portion of the ground water plumes. Alternative 2 is easier to implement than Alternative 4, and both have been identified by the EPA as being similar in effectiveness. Therefore, based on the NCP, Alternative 4 should have been eliminated.	As stated in the Proposed Plan, Alternative No. 2 is not protective because natural attenuation alone will not meet aquifer cleanup levels within a reasonable timeframe. Furthermore, the plume would migrate a significant distance, estimated to exceed one mile in the case of the western plume, further contaminating clean aquifer areas. Because Alternative 2 is not protective, it is not cost-effective. See responses to IMC Magnetics Corp.-Mr. Jenkins' Comments No. 08.0, 09.0, and 09.1. See also the response to Unitog Rental Services Corporation-Mr. Kuhlmeier's Comment No. 32-1. EPA, not CH2M HILL, has selected Alternative 4 over Alternative 2 and, in so doing, has acted consistently with the NCP.
33-2	The results of the sensitivity analysis show that cost would significantly increase for Alternative 4 if the extent of contamination was more than estimated, if COC concentration increased, or if the end use of treated water was different than anticipated. Taking into account the many data gaps remaining after completion of the RI, the possibility of the cost for Alternative 4 increasing as much as 50 to 100% needs to be considered before a final selection can be made. While these potential uncertainties may impact Alternative 2, the resulting increase in cost would be insignificant.	As shown and explained in Table 9-2 of the FS, a change in influent concentrations by 50 to 100 percent will not increase the cost as significantly as 50 to 100 percent. Feasibility study cost estimates are generally expected to be accurate within +50 to -30 percent of actual costs. In any event, because Alternative 2 is not protective, it is not cost-effective. See response to previous comment.

Comments from Unitog Rental Services, Inc.

Dated 11/25/1997 by Paul D. Kuhlmeier, Ph.D

No.	Comment	Response
35-0	Careful analysis of the available facts by the process and guidelines set forth under the NCP, leads to a simple conclusion. EPA has proposed the wrong remedy for this site. Continued monitoring of ground water quality and institutional controls should prove sufficient to show that natural attenuation is fully protective of public health and the environment into the future. Based on our assessment of the data base, institutional controls will only be required for a relatively short period of time, i.e., less than 10 years, and only within area comprising less than 20 percent of the area now outlined in the three plumes. The majority of the study area can be released for unrestricted use today.	This comment conflicts with subsequent modeling efforts presented by Unitog. The results of their modeling are very similar to EPA's modeling. That is, the eastern contaminant area will migrate possibly more than 2,000 feet south before reaching MCLs. EPA has not selected the wrong remedy for the site. See responses to Unitog Rental Services Corporation Comments No. 32-1, 33-1, and comments referred to therein, and the response to IMC Magnetics Corp.-Mr. Hudson's Comment No. 7-4.0.

Comments from Warner Ranch Landing II Association

Dated 11/10/1997 by Mitch Hamlin, VP

No.	Comment	Response
1	The Warner Ranch Landing II Homeowner's Association is concerned about the discharge of treated groundwater of the three listed destinations for the treated effluent, we request that discharge into Tempe Canal # 6 be eliminated. This canal is the only source for the water treatment plant which provides water to our homes and to all of south Tempe. Even if there is only a remote possibility of contaminating this source, another destination for the treated effluent should be found. Therefore, we request that one of the other alternatives be used. Either deliver the treated water to Tempe's storm drain system or re-inject it into the adjacent aquifer. Since none of these alternatives will endanger our homeowners, we urge you to act upon them and to eliminate Tempe Canal #6 as a choice. There may also be a 4th option. It might be possible to deliver the treated water to Tempe's town lake now under construction.	EPA recognizes the Association's concerns about the SRP Canal end-use option and will take these concerns under consideration during the final end-use determination. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA intends to keep the community involved in the end-use selection process. Any extracted groundwater would be treated at least to health-based protective levels before discharge to any end use. Thus, no contamination of drinking water supplies would occur, even if discharge is made to SRP Tempe Canal No. 6. Sending the treated water to Town Lake is one of the current end-use options considered in the FS and Proposed Plan; it would be the end use for groundwater discharged to the Tempe storm drain. This option remains under consideration.

Comments from Warner Ranch Phase II Association

Dated 10/27/1997 by Jerry Mosteller, President

No.	Comment	Response
1	The Warner Ranch Phase II Association is an incorporated homeowner's association in south Tempe representing 399 homes with a gross value of more than $75 million dollars. As a homeowner's association, we are entrusted with protecting and/or enhancing the value of our neighborhood. As such, we are very concerned when a proposal surfaces which could detrimentally affect it. Such could be the case with one of the discharge alternatives in your preferred alternative. We concur that your preferred alternative, Alternative 4, is probably the most realistic. We write you today to request that the discharge to the Tempe Canal No. 6 be eliminated as a destination for the treated water. Actions affecting the Tempe Canal No. 6 greatly concern us as it is the source water for the South Tempe Municipal Drinking Water Plant, which serves drinking water to the south half of the City of Tempe. It seems incredulous that the EPA, who's goal is to "Protect Public Health" would place treated contaminated water into a public drinking water supply when two other good alternatives for the discharge have been identified and are both technically and financially feasible. Our reasons for not wanting the water discharged into our drinking water supplies are numerous and include: The risk that the contaminant removal process and/or quality control systems may malfunction and introduce non- or under-treated water into our drinking water source supplies for days, months or even years before detected. Such has been the case we understand with a similar pollutant removal system within the City of Scottsdale. There is little doubt that home values in that area have been affected since the plant malfunctions have been made public. Even if all the VOC's are removed, there may be other contaminants in the South Indian Bend Wash groundwater that are just as harmful to the public health, but have not been identified nor are removed with the proposed VOC removal process. Again, since there are two good alternatives for discharging the Indian Bend Wash Superfund Site groundwater to non-municipal drinking water supply destinations, why would the EPA seriously consider introducing the treated water to the raw drinking water supply for 150,000 residents? Again, we ask you to eliminate the alternative of discharging treated water into the Salt River Project Canal No. 6 from any proposed remediation project for the South Indian Bend Wash Superfund Site, in order to comply with the EPA's goal of "Protecting Public Health."	EPA recognizes the Association's concerns about the SRP Canal end-use option and will take these concerns under consideration during the final end-use determination. As stated in the Proposed Plan, "the exact end use for the treated groundwater will be determined after EPA has considered all comments received on [the] proposed plan and performed remedial design work for the remedy." EPA intends to keep the community involved in the end-use selection process. Any extracted groundwater would be treated at least to health-based protective levels before discharge to any end use. Thus, no contamination of drinking water supplies would occur, even if discharge is made to SRP Tempe Canal No. 6. The City of Tempe routinely collects groundwater samples from its production wells, and samples would be collected routinely to monitor the treated discharge water to prevent the situation where water is discharged that contains concentrations above health-based protection levels. Also see response to Warner Ranch Landing II Associates Comment 1.

EPA

REGION IX

INDIAN BEND WASH * SOUTH AREA

PUBLIC MEETING

FOR THE

PROPOSED PLAN

FOR CLEANUP OF GROUNDWATER CONTAMINATION

September 24, 1997
7:00 o'clock p.m.
Gililland Middle School
Tempe, Arizona

BARTELT & KENYON COURT REPORTERS
234 North Central Avenue
Suite 430
Phoenix, Arizona 85004
(602) 254-4111

APPEARANCES:

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MS. KATHY STEUER
Assistant Regional Council
U.S. Environmental Protection Agency

MR. MIKE MONTGOMERY
U.S. Environmental Protection Agency
California/Arizona Cleanup Division
Superfund - San Francisco, California

September 24, 1997
Tempe, Arizona
7:00 o'clock p.m.

MS. ROSEN: Good evening, everybody. I'd like to welcome you and thank you for coming to tonight's meeting which is on the proposed plan for cleanup of groundwater contamination at the South Indian Bend Wash Superfund Site.

My name is Vicki Rosen, and I'm the Community Involvement Coordinator from the U.S. Environmental Protection Agency in San Francisco.

I will start off by introducing the other EPA folks who are here with me tonight. First, in the front row is Roberta Riccio. She is the project manager for this site and the one who you will primarily be hearing from tonight.

Here in black is Kathy Steuer from our office of Regional Council. And next to her is Mike Montgomery, who is Roberta's supervisor and the head of our California/Arizona cleanup section in our Superfund office in San Francisco.

The purpose of tonight's meeting is to review the proposed plan and to take public comment. And before I go over the agenda a little bit more thoroughly, I'd like to just briefly give you an overview of Superfund and where we are in the Superfund process at this site for those of you in the audience who might not be very familiar with Superfund.

The Superfund law came into existence in 1980. It is called the Comprehensive Environmental Response Compensation and Liability Act. It was developed in order to deal with the problem of hazardous waste that existed across the country. There are approximately 1200 to 1500 Superfund sites which have been added to the federal list of hazardous waste sites that warrant federal cleanup. That's what South Indian Bend Wash is, as well as North Indian Bend Wash. And the process is very specific for looking at Superfund sites.

And I will just back up a little bit. The type of hazardous waste that Superfund looks at are not -- it's waste that's happened from past practices before there were regulations on disposal and handling, as well as uncontrolled releases that might happen today.

Where we are in this Superfund process at South Indian Bend Wash is at the proposed plan stage. This has come after we've thoroughly investigated this site, which is what we do during the remedial investigation. We find out what's out there, what kind of contamination there is, and where it is. Then we do what's called a feasibility study which evaluates our options for dealing with the contamination that we found.

And now we are at the proposed plan where we've put forth a preferred remedy, after looking at several alternatives, and have developed this remedy from the remedial investigation and the feasibility study.

So, with tonight's meeting we are going to go over the proposed plan, we are going to review what EPA is proposing, as well as the alternatives that we looked at that we don't feel are necessarily as good as the one that we prefer.

And, most importantly, we are here to hear from the public, to take public comment. We are in the middle of the public comment period. The public comment period was to last only until October 14th, however, it has been extended for 30 days. It will now last until November 13th. So the date that you have on your proposed plan is incorrect, and we will be issuing a public notice so that people who are not here tonight will know that the public comment period has been extended for a month. But on this "Opportunity for Public Involvement" sheet, it does give the correct date for the end of the public comment period.

So, you don't have to voice your comments verbally here tonight if you don't want to. You can fill out a comment form and leave it with us, or you can write your comments and mail them to us at any time during the public comment period. Roberta's address is on the various forms that are available at the back table.

We have a court reporter here tonight who will take your comments for the record, and we ask that you please speak loudly and clearly, and state your name when you get up so we can identify you through your comments, and then we will have your comments on record. And then anybody who mails comments in, that will be part of the record, too.

EPA does not make a selection of a remedy before reviewing all public comments and taking them into consideration. So, at the end of the public comment period, after we have done that, then what we will do is we will decide upon a remedy and we will issue what's called a Record of Decision, or a ROD, which we'll put into place to remedy the groundwater contamination at this site.

I guess the only other thing I'd like you to know is that EPA does have an 800 number, a toll free number that comes directly into my office in Superfund. You can reach any of the EPA team through that phone number. You can leave messages for any of us. It's actually answered by a live person during the day, but after hours if you call there's voice mail, and we really do call you back.

So, if you think of questions after tonight, please don't hesitate to call us. We will try and answer your questions and we will help you in any way we can.

I think I have covered just about everything, so -- Well, Kathy just pointed out to me that we are dealing with groundwater here tonight, but prior to tonight we've already decided upon a remedy for soils contamination, and that happened several years ago; is that correct?

MS. STEUER: Yes.

MS. ROSEN: So tonight we are just dealing with groundwater. And, with that, I'm going to turn it over to Roberta who will give you an overview of the proposed plan. Thank you.

MS. RICCIO: I just mentioned to Vicki that I speak very softly, so if you can't hear me, please let me know.

As Vicki said, I am Roberta Riccio. I have been the project manager for Indian Bend Wash South for about five years now.

And for those of you who aren't familiar with the site or the area, I will just point it out to you. Basically, IBW South is, the boundaries are: to the north is the Salt River, to the west is Rural Road, east is Price Road, and the southern boundary for the investigation area is south of Apache, in between Apache Boulevard and Broadway.

And, basically, we started investigating the site due to solvents that were detected in the city of Tempe drinking water wells. The solvents TCE, trichloroethene, were detected in these groundwater drinking wells. I just want to point out, though, that the city of Tempe has not been using groundwater as a drinking water source since that time. They get their drinking water from surface water from CAP, the Central Arizona Project.

So as a result of detecting those contaminants in the groundwater supply, in the drinking water supply, we started an investigation. Basically it was a soils investigation and groundwater investigation to try to determine what were the possible sources of this contamination in the groundwater.

And, again, as Vicki pointed out, we have a Record of Decision in place for the soils. That was issued in 1993. And what I'm going to go through here is basically our groundwater remedial investigation and tell you what our preferred remedy is.

Basically, our preferred remedy for dealing with the contaminants in the groundwater is a partial containment remedy. Basically, we are looking to extract and treat the highest levels of contaminants in the groundwater. And in the areas where we have lower levels of contamination, we are going to allow the natural attenuation processes such as dispersion and dilution to reach our cleanup levels, and I will go into how we came to that preferred remedy.

Basically, during our remedial investigation we installed wells, both EPA and some of the parties that are involved in doing the work out at the site. Let's see if I can get this right here.

Basically, we have installed wells that are monitoring, wells that were already installed that we used in our monitoring process. What this is, is this is a cross-section here, basically, of the geology and the water bearing units below IBW South. What we have, and where we have installed wells and found contamination is, first, the upper alluvial unit which is the first water bearing zone. Basically, it's soil, sand, and gravel. It extends from the ground surface to about 110 to 150 feet below ground surface. We have groundwater levels at about 60 to 70 feet below ground surface there.

The next unit underneath the upper alluvial unit is the middle alluvial unit, the MAU there. And within the middle alluvial unit there are basically three subunits. We have detected contamination in two of those subunits, Subunit B and C. And, again, those wells, those groundwater monitoring wells in those units are screened in the B Area at about 200 to 350 feet below ground surface, and in the C Unit it is a lot deeper. It is about 350 to 450 feet below ground surface.

And just to give you an idea, basically, of what we have found as far as the extent of solvent contamination, this map here indicates the extent of contamination in the upper alluvial unit and the middle alluvial unit that is above the safe drinking water level.

So, basically, what we have here, the solid lines here represent the extent of contamination of TCE, and PCE, another solvent in the groundwater, that are above or estimated to be above the safe drinking water levels.

And, again, this here represents those areas or boundaries in the upper alluvial unit. And the dashed lines here, you will see, represent the extent of contamination above safe drinking water levels in the middle alluvial aquifer.

Other information that we gathered during the remedial investigation process is, in the upper alluvial unit the ground water flow is mainly towards the south, southwest, but when water flows through the Salt River, there is -- we have seen a shift in the groundwater flow direction and it will shift towards the southeast, and the ground water flow direction in the middle alluvial unit is basically towards the northeast.

So, just to sum up, basically, what -- I will get this right sooner or later. Here we go. Basically, just to sum up -- actually, I want to flip one back, if you don't mind, a minute here. I just want to show you in general where we found certain types of contaminants.

The upper alluvial unit, the plume area, the eastern plume is mainly PCE, or perchloroethene contamination. In these other two areas in the upper alluvial unit, it is mainly TCE contamination, and for the middle aquifer it's mainly TCE contamination in these areas.

I am probably going to repeat myself here but, again, the summary of the remedial investigation in the upper alluvial unit we found PCE and TCE contamination above the safe drinking water levels in the upper alluvial aquifer. But we also have many years of monitoring data from a lot of these wells. We have also seen that there has been a decrease in the concentrations of these contaminants in those wells, so we do believe there is some natural attenuation processes occurring out at the site.

In the middle alluvial unit, for the most part, the TCE levels have been just above the safe drinking water levels for quite a few years. It doesn't seem to be increasing, so they are fairly low levels in the middle of alluvial unit.

So, in knowing this, we have looked at a range of possibilities to -- or, alternatives to address what we have seen out at the site as far as the levels of contamination which are above the safe drinking water levels. And the alternatives that we looked at are stated in the proposed plan that you have, and also in the feasibility study.

One alternative, Alternative One is no action. That's one of the alternatives we are required to evaluate in the CERCLA law, and that is if we were to do nothing, basically, no monitoring and such, and pretty much walk away from the site.

Alternative Two, we looked at a full, just monitored natural attenuation to see if the natural attenuation dispersion and dilution processes which we believe are happening out at the site would be enough to reduce the levels back down to safe drinking water levels in the aquifer in a reasonable time period.

Alternative Three is, we looked at a limited action, which is another thing that we're required to do, basically, under the CERCLA law, and that limited action really is because one of our objectives is to restore that aquifer for future beneficial use, possible drinking water aquifer. We looked at a limited action of wellhead treatment at one of the city of Tempe wells, Well No. 7, and that is basically that that would be used in times of drought. Like I said, the city of Tempe has surface water as their source, but in times of drought or in an emergency, this could be a source of drinking water. Basically, we would be pumping from that one well, treating it, and then it would potentially be distributed as a potable source.

Alternative Four, which is our, EPA's, preferred remedy, looks at extracting the contaminated groundwater, the highest levels, basically, that we have seen in the aquifer, pumping and treating those through a treatment system, and allowing for natural attenuation processes to reduce the contaminants down to safe drinking water levels in the areas where we have lower levels of PCE and TCE contamination.

Again, with these alternatives, we would continue monitoring to make sure that we are meeting our levels.

Alternatives Five and Six are basically the same alternative, we have just varied in the possible discharge options, which I'll get into a little bit more in a few minutes, as far as the discharge options.

But Alternatives Five and Six, we would extract all of the groundwater in the upper alluvial aquifer and in the middle that are above the safe drinking water standards. That would go to a central treatment unit or a treatment unit and then go on for possible different discharge options.

And I just want to run through what we are considering right now to be the discharge options for Alternatives Four, Five, and Six, and we are actually going through pumping the water, treating it at a treatment unit, and discharging it.

We are looking at a possibility of discharge through the city of Tempe storm drains for possible use and recreation use in Town Lake. We are also considering a discharge to the Salt River Project's Tempe Canal No. 6, which we know could go on for further use for drinking water source or irrigation purposes. And also we're looking at re-injection back into the aquifer into the middle alluvial unit.

We are not proposing to make a decision on the discharge options during this Record of Decision, but we do want you to comment on these and consider them as a possible end use option that we will be looking at. We plan to make that final decision on the discharge during the remedial design phase, which would be after we issue the Record of Decision.

With these alternatives -- well, here, I just want to -- I'll get this right sooner or later. I just want to give you an idea here what we mean by the partial containment and the regional containment for extracting and treating those areas.

Here you will see the shaded areas basically represents what we have estimated to be the highest levels of PCE and TCE contamination in the plumes in the upper alluvial aquifer, and that is the area we are proposing to actively pump and treat. The areas outside of the shaded area are the areas that we would monitor for natural attenuation.

And for Alternatives Five and Six, the regional containment, the areas that we would look to pump and treatment are everything within these solid lines here in the upper alluvial aquifer, and also then within the middle alluvial aquifer, the dashed lines there.

Right now the idea is to pump that water after it is extracted, in all the alternatives, Alternatives Four Five, and Six, and convey it to a central treatment plant for possible for air stripping treatment of the PCE and TCE in the ground water. And then from that treatment unit, then we would just, depending on what the discharge was, it would be conveyed from that treatment unit to whatever possible discharge options that we choose. And, again, this is just an estimate really. We have a treatment plant location here. That all will be decided during the remedial design phase, so this is really tentative. It's what we propose, although there will be a lot more details worked out later on.

Okay. When we look at the alternatives, basically, and the feasibility study and what is in the proposed plan, we do have criteria that we -- EPA has specific criteria that we use to compare all the alternatives that we are looking at for treatment remedy, and those are listed in the proposed plan at Page 6. There are nine specific criteria. What we have done so far is gone through seven of the criteria, basically, that are listed in the proposed plan -- well, actually eight, and that are evaluated in the feasibility study also. And there are two remaining criteria, which are state and community acceptance.

The state of Arizona basically does concur with our preferred remedy. They will have the opportunity to comment more, as you all will, during the public comment period. But community acceptance is one of the main reasons why we are here tonight. We have the public comment period, so we do want to hear your comments and concerns, and we will take those into consideration in making the final decision on the alternative that we choose.

There are nine criteria. What you see here is, we have kind of scrunched those down in coming to approximately three objectives that we're trying to achieve during our cleanup and evaluate those alternatives against.

And one is, first of all, to be -- we want our remedy to be protective of human health by minimizing the exposure to the groundwater that's above the safe drinking water levels.

We are also looking to cost effectively reduce the contamination in the groundwater to meet those levels and restore -- basically to restore the contaminated aquifer to a future beneficial use within a reasonable time period, and we have a reasonable time period of 30 to 50 years, which is pretty much reasonable for a groundwater cleanup. It does take quite a bit of time.

And, lastly, we were looking to protect groundwater resources to try to prevent future migrations of TCE and PCE both laterally and vertically throughout the aquifer. So, the alternatives, we looked at each of the alternatives against that criteria.

And, Alternative One, as you will see -- I will go through, just real quickly these alternatives against this criteria: Are they protective of human health? Another one of the criteria is reduction of toxicity, mobility and volume through treatment. And we also want to meet the cleanup levels within a reasonable time frame, 30 to 50 years, and then also cost, to be able to come up with a remedy that was cost effective. If you meet those other criteria more cheaply with one of the alternatives, then that is the one we want to go with.

And here is "No Action." Right off the bat, our first primary thing is to be protective, and this alternative we don't believe will be protective of human health. We would not be doing anything to monitor whether or not these levels of contaminants in the aquifer were reducing in levels down to safe drinking water. So there would be no reduction of toxicity, and we don't believe we'd meet those cleanup standards, at least within that 30 to 50-year time period.

Alternative Two is pretty much the same as Alternative One and no action. We do believe that the natural attenuation processes will be happening, but we don't feel we can rely on those processes by themselves to meet those cleanup levels within that reasonable time frame. This is basically based on the monitoring that we have done. And, again, there would be no reduction -- well, there probably would most likely be some reduction of the toxicity and volume; probably not of mobility, and we would not be able to guarantee that within the 30 to 50-year time period.

Alternative Four, our preferred remedy is -- excuse me, Alternative Three, overall, no, this remedy would not be protective of human health. It would be in the areas where we were pumping and treating specifically from that city of the Tempe Well No. 7. The water that would be pumped and treated would be reduced down to safe drinking water levels before it would be distributed, but throughout the rest of the plume areas we would not be extracting that water and treating it, although there would be some reduction, really, just whenever we would pump and treat from that city of Tempe Well No. 7.

Alternative Four, which is our preferred remedy, we do believe it would be protective of human health. We would be -- yes, we would be reducing the toxicity and volume through treatment in the areas of the highest levels of contamination.

Actually, it would happen throughout the whole entire plume area, but as far as the mobility in the areas that we were not going to actively pump and treat, there would be some migration of the area outside of that that would migrate while the natural attenuation processes were occurring, but we would be monitoring that throughout the process. And, yes, from modeling and other work that we have done, we do believe that we will meet those cleanup goals within that 30 to 50-year time period.

Just quickly, I will put up Alternative Five. Alternatives Five and Six are basically the same, again, just the difference in the end use option as far as the costing here. Yes, as far as protective of human health and the environment. We will be pumping and treating the entire plume area above the safe drinking water levels. There definitely would be a reduction of toxicity, mobility, and volume through treatment, and we do believe we can meet those cleanup levels within that time period.

The main difference, I'd say, in those alternatives that we are saying, yes, we do believe will be protective of human health and the environment just vary in the Alternatives Four, Five, and Six. And, again, Five and Six just vary in the end use. The difference between Alternatives Four, Five, and Six together is just really the amount of water that we're saying we are going to actively pump and treat.

So we do believe that Alternative Four, as Alternate Five and Six, we will still meet our cleanup goals within that time frame, within that 30 to 50 years.

And what we are really seeing is a difference in meeting these other criteria. What it kind of boils down to is the cost and cost effectiveness between these alternatives. And, as you can see, the difference between the partial containment, Alternative Four, and regional containment, Alternative Five, basically, here represents the difference in cost for extracting and treating either the full area where we are above safe drinking water levels, versus attacking pretty much the highest levels within the aquifer. And the difference mainly here in the cost information Four, Five, and Six is due to the costing information for the different end uses that were put through.

Alternative Five represents a discharge to the Salt River canal and Alternative Six is re-injection, which is the most expensive as far as the end use.

So, basically, the alternatives, the discharge alternative through the storm drain, city of Tempe storm drain versus the Salt River canal discharge, our estimates for costs are very similar. They are very similar in the costing.

So, basically, I just want to reiterate, I guess, why we do believe Alternative Four is our -- why EPA prefers that alternative. And, basically, we know that -- we believe it's protective of human health, because we believe we will be able to meet those safe drinking water standards within that reasonable time frame.

We know we would be reducing the

toxicity, mobility, and volume of the contaminants through treatment, and also allowing for natural attenuation processes that seem to be occurring out in the aquifer already, take advantage of those, basically, and let them reduce the lower levels of contaminants in the plume. And, again, we do believe this is the most cost effective of the alternatives that we have looked at. So, that's basically how we came to the preferred remedy.

I want to make sure that everyone is aware we will be looking for comments, and that's one of reasons why we're here.

I am just going to put up a little bit of information on how to comment. It's all listed in the proposed plan, and there's also another sheet you can grab in the back there that lists the EPA contacts and my address and where and when you need to send in written comments. There's also phone numbers for the EPA people, myself, and Vicki. And also, there is for the ADEQ, the Arizona Department of Environmental Quality, a local number. We have been working very closely with ADEQ on a lot of this work. The contacts are listed on those sheets also. But mainly I just want to make sure that you know that if you are going to comment that the comments have to come into EPA, as far as written comments go.

So, with that, I'll just say I just want to let you know also in the proposed plan there is information on where you can get more information on the documents and the information that we used to get to this point here for the groundwater. We keep that information in what we call administrator records. And locally they are located in the Tempe and Scottsdale Libraries, and that information is on the back of the proposed plan. And I actually have this here somewhere. The addresses are on the back. A lot of the data is on microfilm. You can give us a call here. We have a Superfund record center in San Francisco where you can call and -- well, you can contact me and I can put you through to that number, basically, and you can get documents that way.

And, I guess -- I think that's it for right now. I am just going to put this up, leave this up with my address, and the date for submitting comments. And I guess we will now take comments and questions.

MS. ROSEN: And, Roberta, just to add to something you said about the Superfund center in San Francisco, that's the place where you can actually have them make copies of documents for you. They do charge a fee. But you can contact them, because if you go to the library, it's all on microfilm and you can make some copies, but it's not quite as easy. The number, I believe, for the Superfund record center is 415-536-2000, and you can tell them you are calling for the South Indian Bend Wash site and they can tell you how to get copies of documents.

And, with that, I guess we will open up the floor to questions and comments. And let me remind you that we want you to speak loudly and clearly so that Debbie can get your information down accurately. Please identify yourself. We are going to have a couple of microphones, one on either side of the room. If you need them, we will bring them to you, and we will try to answer your questions. But if you make comments on the proposed plan, they don't really warrant a response, so we will not be responding to comments on the plan.

And right now we will just open the floor.

MR. KAMIENSKI: Eric Kamienski; I work for the city of Tempe, Environmental Services. I apologize for the rugrats. He doesn't realize the whole program is about him and all the other rugrats we are trying to protect.

One comment would be, it would be nice if you could put this on a web site so we would be able to look at it.

Number two is a question about Proposal Number Four. Will you be obtaining an end use permit for the discharge to the storm drain, because our section is responsible for storm water quality and monitoring in Tempe, and this would fall under our jurisdiction, and I don't know where you are going to fall in that option. What's being done?

MS. RICCIO: Okay. Well, in general, when we do make a determination on the end use, typically we have requirements that we have to meet in following any of our remedies. We call them ARARs, applicable or relevant and appropriate requirements. And we would make an evaluation, and we will make a final evaluation as to what all those requirements are during the Record of Decision time.

If we believe that we would fall into that category of requiring a permit, we would not actually -- EPA will not actually need the actual permit, but we would make a determination to meet the substantive requirements of a permit process, making sure that we are addressing -- you know, if there are certain discharge levels into a certain end use option, we would be making a determination whether or not we meet those and could meet those. As far as obtaining an actual permit within the Superfund, we don't actually need to go through and actually get the permit, but we would meet all the requirements of a permit.

So, we wouldn't most likely, if we -- if our discharge option would require that, and we make that determination, we would be in contact probably with your office. But, as far as getting an actual permit or written permit in hand, we are not required to do that.

MR. KAMIENSKI: Thank you.

MS. ROSEN: We have got somebody over here.

MR. KASWORM: Just out of curiosity, how much water are you going to get out of these wells on a yearly basis?

MS. RICCIO: On a yearly basis for our partial -- for our preferred remedy?

MR. KASWORM: Um-hum.

MS. RICCIO: We are looking at about, I believe it's about 5,000 gallons per minute.

MR. KASWORM: Any idea what that terms out to, how many acre feet per year?

MS. RICCIO: Acre feet per year, I believe it's 9,000 or so.

MR. KASWORM: Nine thousand acre feet per year?

MS. RICCIO: It's a lot of water.

MR. KASWORM: And this being Arizona, there's probably a lot of people who would like that water. Does that water go up for sale, or bid, or what?

MS. RICCIO. Not for sale. You know, as far as the end use options and where the water goes, there are a lot of discussions that need to occur. As far as where, well, I guess we will have to make a final determination as to what our actual remedy is going to be.

MR. KASWORM: But you can't sell it to recover your cost?

MS. RICCIO: We can't sell to recover the cost.

MR. KASWORM: Just a couple of follow-ups.

If we take out all this water from out of the ground, is any of this going to be naturally replaced or is this just going to be a mining operation?

MS. RICCIO: Well, I believe there would be water replacement just through our rainfall, possible seepage back through, depending on what the end use is. But are we going to replace it back, I'm not sure. I mean, that is still a possible option, to re-inject.

But the other options are not specifically replacing the water that we are extracting.

MR. KASWORM: In essence, we're talking about mining this water and cleaning it up?

MS. RICCIO: I don't know how to answer that.

MR. KASWORM: That's all right.

How many wells did you drill?

MS. RICCIO: How many did we drill, how many did the EPA drill for the extraction?

MR. KASWORM: Yeah.

MS. RICCIO: I would say probably about 50, over 50.

MR. KASWORM: Okay. Thank you.

MS. ROSEN: Would you please identify yourself?

MR. ULLINSKEY: My name is Gary Ullinskey (phonetic).

Just to follow up on that question, the Options Five and Six with the regional recovery, what's the projected flow rate on those?

MS. RICCIO: Let's see, the acre feet per year, I believe, is 14,000, yes. I know all that information is in the feasibility study, but I believe it's about 14,000 acre feet per year for the regional.

It's a lot of water we would be looking at taking from the UAU to MAU in that situation.

MR. SANDS: My name is Tom Sands. I live at 251 East Vera Lane in Tempe.

I have a question on funding. Eight point three million dollars initial cost; that was for Alternative Four. If that were chosen, is the funding in place, or what does it look like for the funding? I realize that the money needs to be appropriated -- is that the correct term -- from the federal government. And if that's true, what has been the history of appropriations for expenditures like this?

MS. RICCIO: Well, I guess right now we have not made a final determination as to who would be funding this cleanup remedy. EPA, we will look to some of the responsible parties or potentially responsible parties to offer them the opportunity to really go through to do this cleanup. And within the next few months here, basically after the Record of Decision is signed, we will go through that process really to see if we have any responsible parties and, two, put who are willing to perform the work.

EPA may also -- if that does not work out, EPA would go through and we would be funding that the cleanup remedy. Typically we do have to get -- kind of go through a process really with other sites across the nation, as far as prioritizing funding that comes into our site.

But, basically, if things do not work out, or there may be some sort of combined effort in cleaning up the water, we would be getting funding through Superfund to do this if we are not working with this potentially responsible party to do the cleanup.

MR. GUNNING: My name is Gordon Gunning.

I believe it's been about ten years you've been dinking around with this thing; pretty close. And for most of that ten years I have been asked to do nothing to my property, and don't do this and don't do that, and it has been a rather difficult situation. But now you say it will take 30 to 50 years. I'm sure I will be dead by then. But what's your time table for getting this thing off the ground now that we have come this far?

MS. RICCIO: To get the groundwater treatment system up?

MR. GUNNING: I notice you're going to put a big pipe down Southern or University, or something like that. I figure it'll be another five to ten years before you begin this.

MS. RICCIO: To begin the ground water remedy?

MR. GUNNING: Yes.

MS. RICCIO: No. What we are -- our next step, basically, would be looking to write the Record of Decision. Probably, you know, after we receive full comment, and now the public comment period has been extended to November, I would think that probably early in 1998 we would have a record of decision out. During that process we're trying to -- we will try to be making a determination as to who and how it will be funded. From there, the next steps are remedial design.

As far as -- I'm not sure if your question is when are we going to start --

MR. GUNNING: When are you going to pull the shovel out? When are you going to dig the first ditch?

MS. RICCIO: I'm probably sure it would be probably over a year from now.

MR. GUNNING: I'll put down five.

MS. RICCIO: Maybe two years.

MS. ROSEN: We have somebody in the back.

MR. WOLFE: My name is Douglas Wolfe and I'm an environmental consultant. I do work in the area. And, Roberta, I apologize for the technical nature of the questions, but out of concern perhaps the upper geology is not well characterized. I have a series of questions that I'd like to have addressed.

One of them is: What and where are the highest concentrations? How high is high, and what are the source areas for those?

Two: To what degree is variability in the shallow aquifer a factor in the fate of transport of those contaminants?

Three: If the Rio Salado project goes in, since you recognize that water in the Salt River does change the flow gradients, are the extraction wells placed in areas that will accommodate that?

Four: Do climatic changes -- to what degree is their flexibility in the design systems to accommodate climatic extremities, water in the Salt River?

MS. RICCIO: Okay. I'm sorry, I want to answer you, so if you could repeat them and I will go through each one.

MR. WOLFE: Well, again, I apologize for the lengthiness. I guess, out of concern that the upper alluvial unit, the shallow aquifer units are not well characterized -- that is an assertion on my part -- to what degree does recharge from the Salt River, particularly as it may relate to the planned Rio Salado project, releases in the river, and particularly as they relate to source areas in the highest levels of contamination, how are those addressed within the planned unit?

In other words, are the points of your extraction wells and the units with which you plan to extract flexible enough to accommodate those sorts of change in the hydrogeology?

MS. RICCIO: Well, first I just want to make sure that everyone's kind of aware, you know, that the diagrams and the information that we are showing here are an estimate basically as far as placement of extraction wells. Those were based initially on the data we collected from the remedial investigation and from modeling. It's an estimate, and we know we will have to go out there during remedial design.

We are going to be continuing to collect groundwater data during that process, during the remedial design, and the exact location of those wells would be determined during remedial design. And we would be taking into consideration not only the technical data, the sampling data, flow rate data, and flow direction, but also more logistic things, too, as far as what types of properties and businesses do we have in certain locations. We have to consider access.

On your question about the Salt River and Town Lake, basically, we have looked in our feasibility study. We know that, you know, the groundwater flow has shifted in the past whenever there's water running through the Salt River. Basically, we did take that into consideration in the feasibility study.

Basically, we evaluated a river flow versus a non-river flow situation. We have also been gathering information through the city of Tempe on the Town Lake project also. We had looked at that and considered that.

Basically, the Town Lake effect would, you know, fit within our range of non-river flow and river flow as far as possible shifting the groundwater flow direction. We'll continue to take that into account.

We did the cost estimating. We did a range, basically, on kind of a river flow situation and a non-river flow situation where we might have more volume of water, or the direction of the plumes may shift. And we did take into consideration, and we will continue to do that during the design process, any other effects possibly as the Town Lake goes in. There will be a portion of water constantly there, and we have considered that, and we will continue to take that into consideration during the design process.

A. I guess the one other question was what are the highest levels of contamination in the groundwater?

MS. RICCIO: The highest that we have seen to date in the upper alluvial unit are in -- and perhaps I can put up one of these maps here. The highest levels that we have seen of TCE were about 540 micrograms per liter. Just to give you an idea, the safe drinking water levels for TCE and PCE are five micrograms per liter. So, years ago -- and basically that has been in the western upper alluvial unit plume where we had seen those highest levels. Again, over in this plume area here, more recently those levels have been, the highest level in most recent years has been about 90 micrograms per liter for TCE.

PCE contamination, the highest levels that we have seen have been over in the eastern plume area. I believe the highest levels that we have seen in the past have been between 50 and 60 micrograms per liter. In general, a lot of the levels are not that far above the safe drinking water levels for a lot of these contaminants, and we have seen a reduction in the levels through the years of monitoring.

MS. GAYLORD: My name is Karen Gaylord,

and I'm with the city of Tempe.

I wonder if you could tell us more about the groundwater use restrictions that are referred to.

MS. RICCIO: Very good question. And, basically, you know, I realize they are -- legally, I guess there are no groundwater use restrictions. I guess with that statement we are looking more as a voluntary type action as the city of Tempe and possibly some other users have not been going through to use the groundwater that has been contaminated.

My understanding, I guess, as far as within the state of Arizona, there are no -- legally, there is no way to restrict it. If there are groundwater rights or water rights to certain areas, we could not legally, I guess, prevent people from going through and drilling that well.

What we can, I guess, try to do, I guess, though, is to, if there's a way to -- when people go through to get permits for drilling those wells, that usually goes through the state. And there could be restrictions, or you can try to limit some restriction as far as construction of certain wells so that they would not go into a contaminated area. But, basically, it's just more of a voluntary groundwater restriction.

MR. MONTGOMERY: I can expound on that a little bit. I think we would ask the Arizona Department of Water Resources, who would potentially be issuing permits for those wells, to notify those parties.

And then if we actually had a party that put a well in within the area we were doing remediation in and it disrupted our remediation system, we would have the right to order that party to stop pumping that well. It's called a non-impairment order. In other words, they can't come in and begin disrupting a cleanup system that's in progress by, you know, actively pumping the well. So I think that's why we want to reach out and have some more dialogue with the city about some of these controls and also about the end uses.

MS. GAYLORD: We do have one well right in the middle of the area and one other well in the proximity of that area, but we have not used them for years, but they are on line and they do meet all drinking water standards today.

And we have been hopeful in talking with EPA, hoping that we would be able to use those as well. We rely on them for system shutdown and drought supply. And what we'd like to have further discussion with you about is whether or not you believe we need to abandon those wells. Do we need to lose that resource for the next 30 or 50 years? Is there a potential that we could pump our wells without injuring the remedy?

MR. MONTGOMERY: I think those are all issues we should have further discussions on.

MS. RICCIO: This is the process for that.

UNIDENTIFIED SPEAKER: While you have the map up there, can you tell us where the SRP Tempe Canal No. 6 is and which water plants would be served by that plant?

MS. RICCIO: Let me see if I can pull up this other map. I think it may actually be on here, although maybe it is not. I believe it is down -- it actually is not on here. It is down in this location, this area here in the southern portion.

Am I correct?

MS. GAYLORD: East of Price.

MS. RICCIO: East of Price, but it would lead into over in this area here, and then I believe it goes up on an angle.

UNIDENTIFIED SPEAKER: And it flows south from there?

MS. RICCIO: It flows south from there. And, actually, there is a diagram in the feasibility study which will show some of those possible end use options. It will show the Tempe Canal No. 6 is the Salt River Project canal and the other storm drain area.

UNIDENTIFIED SPEAKER: Now, the storm drain, I assume, goes to the Salt River?

MS. RICCIO: Yes, it mainly goes to the Salt River, exactly. One of the areas I guess we are considering is, I guess, near Dorsey Lane or Rural Road and flows north up into the Salt River area.

MR. LEMMON: My name is Jim Lemmon.

I have a townhouse right over the middle plume there at University and McClintock, and I just wanted to clarify that when I first sampled -- when I worked for the Department of Health Services, it was about 15 years ago that we discovered there's contamination in this area.

I have a series of questions also, primarily dealing with the state ARARs and dealing with the solution to all wells in the area.

Now, my understanding is we spent a lot of time in the state programming to make sure that when there's a remedy implemented it will deal with all wells that are or will be contaminated with hazardous materials.

Particularly, my question goes to the SRP well on the corner of what looks like old Eighth Street and lateral right behind my townhouse. And maybe Tom

Sands from SRP can tell me if that well is still actively pumping, whether it's off line, those sorts of things, but I don't see a mention of that well in this plan.

MS. RICCIO: And your question is?

MR. LEMMON: My question is, basically, I don't see mention of this SRP well in this plan, so how does this plan or any of the proposals meet the state ARARs that we have to follow according to state law?

MS. RICCIO: And that state ARAR being?

MR. LEMMON: That all wells will have a remedy.

MS. RICCIO: A remedy in place. Now, again, as far as the ARARs are concerned, we're still evaluating the ARARs. We will make a final determination in the Record of Decision. This ARAR, I guess I'm not sure right now if that is an actual ARAR, and we will make a determination on that. And I'm not sure if that is that there be a remedy to address all wells. I mean, we are taking into consideration, you know, future cleanup and to clean up the ground water as quickly as we can.

MR. LEMMON: Well, that's what I mean. Let me interrupt. The reason I ask the question is, you call this a containment remedy when you talk about the area of containment. If you straighten the map up again, I will point to that area again. It's right where Eighth Street comes into McClintock. There is a well there. It's right behind my townhouse. It's near your extraction well number four. It's slightly to the north and west of that for the well site.

And my question is: Will there be hazardous materials remaining at that well site at the end of your remedy? And it looks to me that it will, because it's inside that containment.

MR. MONTGOMERY: No.

MS. RICCIO: We are looking to, and I believe, if this is the SRP 29 --

MS. ROSEN: 23.

MS. RICCIO: -- 23 east well, we are looking at also -- all of our remedies are taking into consideration that we would look to close off that well or a portion of that well so that there would not be any possible movement from the upper area down into the middle unit. That is something that we are considering in all of the options.

Basically, you know, our remedy is to meet cleanup levels throughout the whole entire area where we have contamination above the safe drinking water levels. So we believe at the end of the cleanup remedy, yes, we don't expect to have contamination levels above the safe drinking water levels in that area. We are looking at closing off that well, at least a portion, so that there would be no possible movement of water from the upper alluvial unit into the middle alluvial unit.

MR. LEMMON: Well, let me respond. That goes to part of my question, what might you do with that well to prevent it as a source for further migration, and that's great, and I want to ask a question about sources. But my question is: Will groundwater that's remaining at that site be above or below the MCLs, that area inside your dashed line there around that EWA-4 and slightly to the north and west of that where the main portion of that plume is, the extent of the partial target volume, or whatever?

And that's right next to my house, and I want to know, you know, as a property owner and adjacent to SRP, is that site ever going to be used again? Could it be used without some sort of additional treatment, or are we abandoning the well after we make sure it's not a continuing source of migration?

MS. RICCIO: I don't know if we need to make the distinction as far as abandoning the well. We are going to try to look at options to close it off as being a possible source of movement of water from the upper into the lower aquifer.

And our intention is, yes, that this remedy, this preferred remedy either through the active pumping and treating in the upper alluvial unit and still allowing -- we believe in that case we will be taking care of sources in the upper alluvial unit, the highest levels, therefore, allowing more of the natural attenuation processes to happen within the middle alluvial unit, which, because we really are only seeing those at levels -- the levels of contamination in the middle alluvial unit have been and remain to be, for the past few years, about -- between five and twelve micrograms per liter. So, it is at the save drinking water level. We do believe in pumping and treating that upper level and reducing the highest levels of contamination that, yes, those natural attenuation processes will be occurring in the aquifers where there are lower levels of contamination, meaning outside this shaded area, and the UAU, and then also in the MAU. Yes, we do believe, and we have done some modeling to show that at least within our time frame, that 30 to 50 years, that, yes, we do expect to get down we below, to meet at least the cleanup levels throughout that whole area.

MR. LEMMON: Let me make sure I understand your answer. Throughout the entire area that you are showing on the map there on the stream, that all the groundwater at the end of your 30 to 50-year remedy will be below MCS?

MR. MONTGOMERY: Correct, yes.

MS. RICCIO: I won't say necessarily below, but we are going to meet those levels.

MR. LEMMON: My second question deals with what happens when the Salt River flows through the landfills. And you know you have talked to a group of us a while back for the area north of the Indian Bend Wash area about your soil remedy and at the source sites and some of these other areas, but there is no source remedy proposed in the soil for the landfill on the river from Hayden Road to almost Price Road. And I'm wondering, have you identified any sources up in that area or not and, if so, what happens when the river flows again through these landfills?

MS. RICCIO: Well, as far as the soils in the landfill area, we do have some data. We have collected some data. There are a few facilities, at least one or two, that have -- there are other operating facilities that are on top of where some of this landfill area was located, and that is up on this map here. It will be north of First Street -- well, actually, up here where this legend is, is mainly where some of the old landfills are. We have collected some soil gas data.

We have not really seen an elevated level of contamination in the groundwater wells there. We have not really considered the landfills as a very significant source to groundwater in this area, it is some of the areas that we have some of the lower levels of contamination, as far as in the soils.

We have been looking at trying to address some of the sources as far as the soil sources, IBW south, where we're trying to go to the areas where we have the highest levels of contamination and kind of work with that first.

The landfills are, as far as the soils, that's another area that we will address, I guess, as we go through some of the higher levels of contamination. And we're looking at the various ways, I guess, to address the landfill areas, because mainly our Record of Decision that is in place is for volatile organic compounds and solvents in the soils.

I realize there may be some other issues with some of that landfill property. But, again, one of the main reasons where we're trying to deal with some of the higher levels of contamination at the site is, it's a very, you know, pretty big site, and there's a lot of different facilities in the area. The landfills, as far as the levels in the soils have not been as high as we have seen it at other locations. But I know it's still a concern, and we are, you know, are planning to address the landfill area in the future.

MR. LEMMON: So, in response, then, is it fair to characterize this as an operable unit for the south Indian Bend Wash?

MS. RICCIO: The landfills themselves?

MR. LEMMON: No, no, this remedy.

MS. RICCIO: This remedy, yes.

MR. LEMMON: Alternative Four, whatever, Four, Five, and Six.

MS. RICCIO: This is the groundwater operable unit. We had it -- we split the site, basically, as far as the investigation goes, into what we call operable units. We have done it for the investigation for the soils, and now this for the groundwater.

And each time we, EPA has an operable unit the intention is, you know, to split the site up into more manageable units. Each operable unit would have a Record of Decision in place for how we were going to handle the contaminants within that operable unit. And the Indian Bend Wash South is broken up into environment media, the soils versus the groundwater operable units.

MR. LEMMON: And the final question I need to ask, again, with the groundwater treatment plant that you're proposing, I think you said about Dorsey Lane?

MS. RICCIO: Yeah. And, again, that's really -- it's really just an estimate. That final determination won't be made until design time, but --

MR. LEMMON: And I guess one -- there is a proposal by the city of Tempe to build a hazardous waste facility at that same general location. And I guess many of the neighbors in that location are kind of concerned about that, all these sorts of activities in this area where there weren't before.

What are the planning folks in the city of Tempe telling you folks sitting up there about the environmental part, say, by putting a plant in this area?

MS. RICCIO: Well, that is not something that we specifically discussed with the city of Tempe as of yet, and we are putting this out as a proposal, the location. And even, you know, some of the extraction wells, it's an estimate. It's something to give us an idea to start with. I know we will have to probably go through many discussions with the city of Tempe and local agencies to make that final determination as to a location and a lot of the logistics. So, that would be really a good point that you are making, I think, as far as taking that information into consideration during the design.

MR. SCHUMANN: My name is Herb Schumann, and I live in north Tempe. I've got a couple questions also.

My first question is: Where does Indian Bend Wash North stop and Indian Bend Wash South start?

MS. RICCIO: Okay. Let's see. Well, the south area, we basically consider the south area, you know, south of the Salt River. All right. It's transparency dyslexia here.

Basically, the north area -- and, you know, honestly I'm not sure, Mike, as far as the northern boundary of the north area.

Basically, the entire IBW site is about 13 or 14 square miles in area, and the south area is about three to four square miles. So, basically, the north area is up in this location.

MR. SCHUMANN: Specifically the southern boundary of the north area. I attended a meeting of the north EPA last Wednesday and they broke it at McKellips Road.

MS. RICCIO: Ah-hah.

MR. SCHUMANN: We have a no-man's land in between that and where I live. I'd like that clarified.

MS. RICCIO: Consider yourself lucky.

I'm sorry, you said you were at a north meeting or you looked at some north information and they broke off the boundary at McKellips, which I believe --

MR. SCHUMANN: A mile in there.

MS. RICCIO: -- is right in here.

And, there again, some of the confusion there may lie in setting up these lines here as far as a steady boundary. Typically, the definition is sort of -- a Superfund site is the area, the extent of contamination. In this location there may not be groundwater contamination in the area that --

MR. SCHUMANN: Au contraire.

MS. RICCIO: Au contraire, okay.

MR. SCHUMANN: One of the first wells was at McKellips and Indian Bend Wash.

MS. RICCIO: Right. And this basically has been under investigation, in the north area. Basically, the divide here has been the Salt River, just for some of the groundwater flow direction. I mean, the site -- we did start investigating the site a long time ago.

MR. SCHUMANN: I know. I was there.

MS. RICCIO: But --

MR. SCHUMANN: The distinction is an administrative one, not a hydrologic one.

My next question goes to Alternative One, no action.

MS. RICCIO: Um-hum.

MR. SCHUMANN: Can you legally do that under the existing law?

MS. RICCIO: No. I mean, we -- we could if it was protective, basically, if it met criteria, if we went through this site in particular, did an investigation, and realized there was no risk from those contaminants or maybe the contaminants were very low.

In this situation, no, we do have contaminants at least that are above, we know, the safe drinking water levels. We performed a risk assessment evaluating that data. And, no, I mean, we have to evaluate against nine criteria basically in the NCP or within CERCLA, within the Superfund law.

MR. SCHUMANN: Yes, under CERCLA and RCRA, I don't think you could.

MS. RICCIO: Under CERCLA we are required to look at it and evaluate it in a feasibility study.

MR. SCHUMANN: Have you gone through your Alternative Four? My question goes to the riverbed and Town Lake associated with Rio Salado. I attended a meeting on the -- the ground recharge meeting.

At that meeting we were told that the city would be pumping wells on both sides of the river to abate the infiltration which would be going through the river bottom. I thought it was rather interesting that this was going to come in at about a million dollars a year, and over a 50-year design life that is exactly equal to your cleanup for the total most expensive option.

My question, though, goes to the hydrology, and was that pumping modeled into and considered in the resultant of your alternatives?

MS. RICCIO: I'm sorry, and the question is did we consider that information in evaluating our alternative?

MR. SCHUMANN: Did you model it?

MS. RICCIO: Yes, we did, during the feasibility study. And, again, we have been in contact with the city of Tempe to notify us in some of their initial plans and design plans. We did take that information into account in our modeling. Again, we evaluated that information, and that was provided for us from the city of Tempe.

Again, we didn't believe there was any difference outside of the range that we were looking at in our feasibility study, because we did consider a non-river flow in the Salt River versus river flow through the Salt River. And the effects of the city, the Town Lake basically fit within that range, the potential for that additional groundwater or influx of water from the Town Lake was no greater than the scenario if the river was flowing and would flow at certain times.

So, in our cost estimates -- now, I have put up one, you know, cost estimate. In this, although we didn't look at it in the feasibility study, we have a range of cost estimate. If you look in the appendix we have a range of costs with estimates on the volume of water in a situation where there's no river flow, versus a river flow situation.

We had looked at the city of Tempe Rio Salado project work data and realized that if there was possible increase of river water there into IBW south that we have -- we're designing or estimating a design for a system to handle that. It would basically be --

the contribution, basically, from Salt River, Rio Salado would not be any greater than the scenario where the water would be flowing through the Salt River.

And we'll continue to evaluate that too. I mean, we looked at it as far as volume, and also the potential for possibly shifting the groundwater flow direction in the South Indian Bend Wash. During Town Lake, when the Town Lake is built, there would be a steady area of water there. So we did take that into consideration and we will still continue to do that.

MR. SCHUMANN: Did you model the effect of putting the storm drain to fill the lake up?

MS. RICCIO: I'm sorry, did we model --

MR. SCHUMANN: You got one scenario where you've got water in the river --

MS. RICCIO: Right.

MR. SCHUMANN: -- and another one where you have the standing body of water. You said that you had modeled those?

MS. RICCIO: Right. What we did, is we modeled -- we looked at no river flow in the Salt River, versus the scenario where there would be water flowing through the Salt River, because we know that we have in the past seen effects in our groundwater monitoring wells when the river is flowing when it was -- and I'm not sure if I'm making this clear.

When we looked at the information that was provided for us from the city of Tempe on Town Lake, we looked at the possible effects of the Town Lake on our groundwater flow, direction, and volume, and we realized that the effects from that would be no greater than the scenario of the groundwater flow through the Salt River, which we believe would be our most drastic, you know, effect of possibly volume of water coming through the aquifer from the river flow and shifting the water direction.

So, the Town Lake is -- we would not have any greater effects than we have already considered, basically, is what I'm trying to say. It would be minimal effects, and we have taken steps.

MR. SCHUMANN: You are considering a total flow of the river all the time as the worst case scenario?

MS. RICCIO: That's the worst case scenario, right.

MR. SCHUMANN: And that -- what about the Town Lake?

MS. RICCIO: Well, the Town Lake is not that extreme. The effects of Town Lake would not be as extreme as the effects of full river flow through the Salt River on the effects of monitoring wells at IBW South. There would be basically minimal effect, or less than the total effects that -- I don't feel like I'm explaining this very well.

The river flow through the Salt River is the worst case scenario, no river flow is our best scenario, as far as the volume of water going through, and the Town Lake effects is in the middle between those two. But when we have considered all of the alternatives, and we considered that full range, non-river flow is the least worst case scenario.

So we have taken that information into consideration as far as the volume we might have to pump and treat, and we will continue to do that during our design as Town Lake is constructed. We will still continue to do that. We will be doing more modeling basically, too, during the design process to set up a treatment system.

MR. SCHUMANN: Is your analysis available for people to look at?

MS. RICCIO: Yes. The feasibility study, mainly, has all that modeling information in it. We have a remedial investigation report that is out also that is in the administrative record. That has all our groundwater data, and it has -- I do believe we have some of the modeling information, groundwater flow and direction information in the remedial investigation report. Some of it is summarized in the feasibility study. But those would be your main documents that you would be looking at for more detail as to how we evaluated the data and the river flow.

MR. SCHUMANN: Thank you.

MR. SANDS: I'm Tom Sands.

I've read in the technical publications recently about some success that has been had in the use of microbes, organic-eating microbes that are placed down in a well. And, actually, if I understand the process right -- I am not a chemist, but if I understand the process, it converts the organic contaminants to something like carbon dioxide and water. It's a relatively new science and it certainly is showing some promise in certain applications. Has something like that been considered here?

MS. RICCIO: No. What we have evaluated, though, is, in our feasibility study and the natural attenuation, we took a look to see if there are existing microbes there, basically, already in the ground, really, to see if some of the processes that we're seeing and some of the reduction could possibly be due to biological reduction. And, for the most part, no, we haven't seen that. We don't see an indication of that at IBW South. And overall, no, we had not considered the introduction of microbes into wells to facilitate that process.

MR. SANDS: Okay. Thank you. But should it be?

MS. RICCIO: Should it be; I don't know. Actually, to be honest, I don't know enough about the process.

MR. MONTGOMERY: Are there EPA guidelines that would prohibit that being looked at? Is it too new a science?

MR. MONTGOMERY: No, it's not that they're new. There is a study being done at the Tucson airport on microbe integration in groundwater. Typically, you need microbes and you need nutrients, and you have to then place the nutrients in the subsurface, and you have to have certain qualities in the subsurface for that to occur.

For this large an area, doing a project like that would be really risky, plus you generally need, you know, high concentrations of contaminants, or at least that would be the type of project you would want to work on where you have higher concentrations of contaminants than we have here. So, it's a great idea, it's being developed, but it's probably, for a number of different reasons, not appropriate for this type of a site. That's just my --

MR. SANDS: Thank you.

MR. MONTGOMERY: That's my explanation of it. I am in no way an expert.

MR. SANDS: Somebody else was asking a question, but can I ask one more?

MS. RICCIO: Sure.

MR. SANDS: This goes back to the discussion about mining the groundwater out of that area and is anything going to be done to replace the water back in.

Just kind of a layman's observation, if you've got the Town Lake project, whatever it is, a mile or two away, or maybe closer, it would seem to be a wonderful process for getting water back into the ground after it's cleaned up if you could pump the water out of the ground, treat it, put it in the lake, and then not have Tempe pump certain wells on that end of the lake and let that water naturally go back into the void that is caused from the original pumping.

MS. RICCIO: Is that a comment?

MR. SANDS: That's a comment, or do you want to respond to that?

MS. RICCIO: Well, I guess, one thing I could comment on it, I know that, basically, that that may possibly benefit our remediation. That would have to be something that would have to be considered as far as continually moving water through the Indian Bend Wash, but that wouldn't be too good of a way of keeping the lake in place, basically. They know, I guess initially, there's going to be a lot of seepage from the lake, I believe, when it first starts up. That's one of the reasons why they want to be able to pull back through water into the system.

As far as the design of our system, again, during design we will be taking into account a lot of different factors out in the IBW South areas as far as the groundwater flow. We, you know, determine our rates of extraction in accordance with the other information, ongoing information of what's happening out there in the IBW South area.

MR. SANDS: Could that still be an alternative to -- Alternative Four you talked about three different ways of discharging the water, or has that been completely eliminated? Is there a fatal flaw in using the Town Lake as a recharge, basically?

MS. RICCIO: Mike?

MR. MONTGOMERY: Yeah. You know, maybe I

can address that. I think that, from our standpoint, we're looking for what we call beneficial end use. We're going to be looking for the Arizona Department of Water Resources to advise us and ADEQ to advise us what they consider the beneficial end use is.

If we were to select a discharge option that gave the water to the city for use in Town Lake, I think it would be up to the city to determine how they want to operate Town Lake with regards to what and how they would want to continue to operate. Do they use extraction wells, to what degree they rely on ours.

I think it's a difficult question for us to answer because Town Lake is not our project, and we don't really -- you know, it's not appropriate for us to comment on its operation. We're just looking for an appropriate, beneficial end use for this water.

MS. ROSEN: Can we let Karen talk now?

MS. GAYLORD: Karen Gaylord.

Just one comment on that point. The city of Tempe, throughout the last ten years, we have done whatever we could to accommodate the local and federal agencies in our planning of Rio Salado.

And we originally had looked at operating the lake as a recharge facility. Concerns were expressed by various agencies, conservationists, about the effects that it might have on local groundwater contamination. And so it was on the advice of the agencies, basically, that we put in seepage recovery systems so we could recover all the water seepage throughout the project. We are open to suggestions, though. And if, in fact, the agencies thought it would be more beneficial to the environment, we are certainly open to discussion from you and the EPA agencies on that subject.

MR. LEMMON: Jim Lemmon again.

I have another question. I heard earlier from the EPA that if somebody pumped a well and it was interfering with your capture plan, you would issue a noninterference order.

Now I just heard you tell us that you would allow the city of Tempe to operate their Town Lake capture recovery tank on their own and you wouldn't tell them what to do, and all this hydrology is connected. I guess I'm a little bit confused. EPA and one of the cities in Arizona got into a dispute about a beautiful lake up in Prescott and it is now a muddy mess because the communication wasn't too good from that standpoint. And I guess I'm really concerned now. We're planning to put water in that lake and do what's best for the city of Tempe and best for the environment. If we don't have a good open communication in this process, we're going to end up with a slimy mess probably worse than when they drained Glen Canyon.

MR. MONTGOMERY: You raised a really good point. I can't address that Glen Canyon part, but I think -- you know, I think that we have got a community group, you know, operating at North Indian Bend Wash. I think it might be appropriate in the near term future for us to try and form a group here at South Indian Bend Wash that would include water users, it would include municipalities, it would include community interest groups, potentially include representatives from the university, representatives from the parties where we would sit down and talk about some of these issues.

We have been considering that, and I think what I hear you saying is that something like that would be appropriate in order to avoid potential future conflicts.

So, I guess, I would say at this point if there are individuals in the group that can -- that represent organizations that have an interest in the long term of this project that we would be interested in hearing your name and your organization for the purposes of potentially planning sort of an advisory panel to help the agency on issues, particularly with regard to end use of the water and siting of the facilities.

MR. WOLFE: Doug Wolfe again.

Could you address potential, possible recovery mechanisms?

MS. RICCIO: Potential, as I stated earlier, within the next few months here I guess we will be going through to kind of try to make a determination as to who we believe the potential responsible party or potential responsible parties are for the groundwater. We have had initial contact with those parties, and we will be doing that over the next few months really, as far as looking for parties to perform the groundwater cleanup.

During those processes, depending on what route we go, if there's a consent decree possibly put in place, we would address that past cost in that for our remedial investigation work. So we do have a format, the details of which we are still working out. But that is something we're considering now, and through the ROD or the proposed plan, public comment period, we'll be working on that. And, of course, right after the Record of Decision is put in place, we will be looking at having discussions with responsible parties in that again we will just be looking for future cost for the remedies and also to address past cost on site.

MR. WOLFE: Would it be fair to say you are integrating a lot of different interests to get an integrated system so the system could go forward as designed irresponsive of whether or not PRPs are identified and responded, or does it depend to some degree whether they tie you up in court and things like that?

MR. RICCIO: I'm sorry, can you repeat your question?

MR. WOLFE: Right. I mean, is the system going to go ahead as designed irresponsive of whether or not the PRPs come forward and do their assigned duties, or are they capable of tying you up in court if they fight it?

MS. RICCIO: Well, I believe that what we will do is we will discuss, you know, options with the parties. If there's something else that is presented that would still meet our cleanup goals, we're open to discussion with the responsible parties, or we would be open to discussion with the responsible parties. If it appears that we are not moving forward in that realm, I think we probably would go back through and look at using Superfund money to do our preferred plan, or whatever the actual plan turns out to be in the Record of Decision.

Again, once we do go through and contact responsible parties, we would do that through a special notice process. And within that special notice process there is a time line set up, a moratorium, basically, for negotiations. And we would make determinations during that time whether or not it looked as if the parties would be interested in going through to conduct a remedy, and we'd start at least with a basis or a time line for those discussions and negotiations for doing that.

MS. STEUER: I'm Kathy Steuer for the EPA Office of Regional Council.

I think Roberta gave a great answer. I would add that EPA also has a third option, which is to issue an order to potentially responsible parties to require them to proceed with the cleanup. So we have several different options to insure conduct of the remedy and to facilitate recovery of the government's past costs.

MR. WOLFE: I guess I'm not quite clear with the system as it would be implemented. Would it be EPA's contractor that would build and design the system or would it be a group of PRPs that would do that?

MR. MONTGOMERY: We haven't determined any of that yet. We're just beginning to open up a dialogue with some of the companies who recognize that they're -- you know, it could be a combination of private and federal effort. It could be a private effort. You know, we haven't even determined any of that at this point.

MR. WOLFE: I see.

MS. LAWSON: My name is Cecelia Lawson, and I live in Tempe.

Where is the hazardous waste going after the treatment?

MS. RICCIO: After the treatment? Well, hopefully in the treatment we will be reducing the hazardous waste. We will be treating the groundwater, so that after it's treated the level will be very low or at safe levels, or safe drinking water levels. Where it's going to go, we are stating we are not making a final determination until --

MS. ROSEN: I think the question is what happens to the contaminant; is that right?

MS. LAWSON: Yes, that's right. How do you get rid of them? What happens to them? Where do they go?

MS. RICCIO: Okay. Basically, I will put this up here as an example of -- we looked at air stripping as a possible treatment option. Okay.

And this is one of the options, basically, that the air stripping -- it could be a different type of treatment, but mainly we are looking at this probably as the best treatment for the types of contaminants that we have in the groundwater.

What happens is, we extract the contaminated groundwater, it comes up through a central piping system into an air stripping unit. It could be a tower or something, so to speak.

Basically what happens is, we have air moving up through this column. As the groundwater comes in, it flows down through here. The contact of the contaminants, because they are volatile organic compounds they tend to evaporate, they would be pulled into the air stream. Basically, that air stream would then flow into here into another treatment unit where they would be absorbed through carbon or another type of resin that they would absorb to, so then that clean air is coming out this area. The contaminants are trapped, basically, within this unit here.

And then eventually the contaminants within that area are taken off for possible recycling, or we would deal with the contaminants within that containment possibly off site, as far as removal, so that all the air going back up into the atmosphere would be free of those contaminants, basically. So, it's removed from the water first, moved into an air treatment, and then trapped within a carbon or a resin-type material in that second phase.

MS. LAWSON: My second question is: With all this water that is being removed from the ground, is there going to be a void there and maybe a cave-in, or, you know, like in Tombstone when they mined there?

MS. RICCIO: No. I mean, we would be adjusting our flow rates and extraction rates, basically, to accommodate that. There's quite a bit of groundwater movement and flow through that area, and we would be adjusting our rates really so that we would be extracting and trying to get the levels of contaminants out as quickly as possible.

But we would balance that, basically, the extraction rate so that we are not -- I don't really believe we have the capacity really to pull out that much water, because there is so much in the aquifer, that quickly to cause that type of problem. But we consider that in the design phase as far as the flow rate for extraction from the wells.

MS. ROSEN: Do we have any more questions or comments?

Well, with that, then, I guess we will say thank you very much, and if you have any questions, give us a call.

MS. RICCIO: Okay. Thank you.

(Whereupon, this public meeting adjourned at 8:52 o'clock p.m.)

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STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, Deborah L. Tucker, a Notary Public in and for the County of Maricopa, State of Arizona, do hereby certify that the foregoing 70 pages constitute a full, true, and accurate transcript of the proceedings had in the foregoing matter, all done to the best of my skill and ability.

WITNESS my hand and seal this 24th day of September, 1997.

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Notary Public

My commission expires:
October 29, 2000